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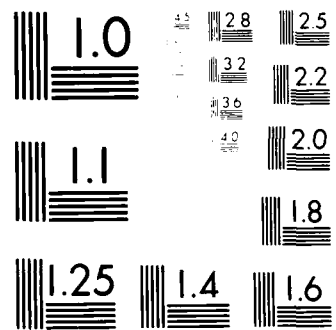
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AIR FORCE INTEGRATED READINESS MEASUREMENT SYSTEM (AFIRMS)

EVOLUTIONARY IMPLEMENTATION PLAN

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31 May 1985

Prepared for

United States Air Force
Readiness Assessment Group

Contract No. F49642-83-C-0022

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SECTION I. GENERAL

1.1 Purpose of the Evolutionary Implementation Plan (EIP). The purpose of the AFIRMS EIP is to provide the necessary planning and scheduling information to life-cycle management personnel, functional users, and data processing personnel for developing and implementing AFIRMS worldwide. The design, development, installation, and operation of the AFIRMS system are evolutionary. They are accomplished in an incremental series of modular steps for HQ USAF, each Air Force major command (MAJCOM) headquarters, intermediate headquarters (where appropriate), and wing/base/squadron elements. The EIP provides a top-down frame of reference to shape the evolution and implementation of AFIRMS. This EIP document provides the highest level definition of the implementation plan. It provides the overall organization, top level schedules, and explanation of the work efforts required for AFIRMS implementation. Annex A contains the AFIRMS Management Plan. Appendix A contains an overview of MAJCOM implementation schedules. The other EIP Appendices detail how the implementation will evolve within each MAJCOM. The EIP is intended to be a "living" document which is updated periodically to reflect the current AFIRMS implementation planning.

1.2 Project References. Accurate assessment of force readiness and sustainability has been a constant concern of Air Force Commanders and their staffs. This concern has been supported by an intensified DoD-wide interest in capability. In response, the Air Force Directorate of Operations and Readiness initiated the AFIRMS Program. AFIRMS has been under development through a learning prototype and is being designed to provide Air Force Commanders with a complete, timely, and accurate assessment of their operational readiness and sustainability.

The Program Management Office (PMO) responsible for contract management of the AFIRMS Learning Prototype Phase (LPP) and this EIP is the Data Systems Design Office (DSDO/XO), Gunter Air Force Station (AFS), Alabama; the Office of Primary Responsibility (OPR) is the United States Air Force Readiness Assessment Group (AF/XOCIM). Three operational centers were used as LPP testbed sites: The Pentagon, Washington, D.C.; Headquarters United States Air Forces Europe (HQ USAFE), Ramstein Air Base (AB), Germany; and, the 52nd Tactical Fighter Wing (TFW), Spangdahlem AB, Germany.

- a. AFIRMS Data Requirements Document, Final, SofTech, Contract No. F49642-83-C-0022, 31 May 1985. (Unclassified)
- b. AFIRMS Economic Analysis, Final, SofTech, Contract No. F49642-83-C-0022, 31 May 1985. (Unclassified)
- c. AFIRMS Evolutionary Implementation Plan, Final, SofTech, Contract No. F49642-83-C-0022, 31 May 1985. (Unclassified)
- d. AFIRMS Functional Description, Final, SofTech, Contract No. F49642-83-C-0022, 31 May 1985. (Unclassified)
- e. AFIRMS HQ USAF Database Specification, Final, SofTech, Contract No. F49642-83-C-0022, 31 May 1985. (Unclassified)
- f. AFIRMS HQ USAF Subsystem Specification, Final, SofTech, Contract No. F49642-83-C-0022, 31 May 1985. (Unclassified)
- g. AFIRMS HQ USAFE Database Specification, Final, SofTech, Contract No. F49642-83-C-0022, 31 May 1985. (Unclassified)
- h. AFIRMS HQ USAFE Subsystem Specification, Final, SofTech, Contract No. F49642-83-C-0022, 31 May 1985. (Unclassified)
- i. AFIRMS Product Descriptions, Final, SofTech, Contract No. F49642-83-C-0022, 31 May 1985. (Unclassified)
- j. AFIRMS System Specification, Final, SofTech, Contract No. F49642-83-C-0022, 31 May 1985. (Unclassified)
- k. AFIRMS Transform and Model Descriptions, Final, SofTech, Contract No. F49642-83-C-0022, 31 May 1985. (Unclassified)
- l. AFIRMS Wing Database Specification, Final, SofTech, Contract No. F49642-83-C-0022, 31 May 1985. (Unclassified)
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- p. System Interface Design for the AFIRMS LPP and the Air Force Operations Resource Management System (AFORMS), SofTech, Contract No. F49642-83-C-0022, 2 November 1984. (Unclassified)
- q. AFR 700-2, Information Systems Planning, 26 October 1984. (Unclassified)
- r. Automated Data Processing (ADP) Security Policy, Procedures, and Responsibilities, AFR 205-16, 1 August 1984. (Unclassified)

- s. AFR 300-4, Vol. 4, Air Force Data Dictionary, 1 May 1984. (FOUO)
- t. Automated Data Systems (ADS) Documentation Standards, DoD-STD-7935.1, 24 April 1984. (Unclassified)
- u. Department of Defense Dictionary of Military and Associated Terms, JCS Pub 1, 24 April 1984. (Unclassified)
- v. AFR 700-1, Managing Air Force Information Systems, 2 March 1984. (Unclassified)
- w. AFIRMS LPP ADP Security Plan, SofTech, Contract No. F49642-83-C-0022, 13 February 1985. (FOUO)
- x. AFR 300-4, Vol. 3, Air Force Data Dictionary, 15 August 1983. (FOUO)
- y. Sustainability Assessment Model (formerly CAC) Functional Description, Contract No. F33700-83-G-002005701, 8 April 1983. (Unclassified)
- z. AFR 700-3, Information Systems Requirements Processing, 30 November 1984. (Unclassified)
- aa. MIL-STD-480 Configuration Control-Engineering Changes, Deviations, and Waivers.
- bb. MIL-STD-483 Configuration Management Practices for Systems, Equipment, Munitions, and Computer Programs.
- * cc. USAF Operational Major Command Functional Area Requirement (FAR), SofTech, Contract No. F49642-82-C-0045, 15 December 1982. (Unclassified)
- dd. Unit Combat Readiness Reporting (C-Ratings) (Unit Status and Identity Report (UNITREP), RCS:HAF-XOO(AR)7112(DD)), AFR 55-15, 22 November 1982. (Unclassified)
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- * ff. AFIRMS FAR, SofTech, Contract No. MDA-903-76-C-0396, 14 March 1980. (Unclassified)
- gg. AFIRMS Data Analysis, SofTech, 15 February 1979. (Unclassified)
- hh. User's View of AFIRMS, SofTech, 1 November 1978. (Unclassified)
- ii. AFR 700-9, Information Systems Standards, Volume I, 15 March 1985. (Unclassified)
- jj. U.S. Air Force Glossary of Standardized Terms, AFM 11-1, Vol. 1, 2 January 1976. (Unclassified)
- kk. AFIRMS Data Automation Requirement (DAR), Final, SofTech, Contract No. MDA-903-76-C-0396, 14 March 1980. (Unclassified)

*Material contained in references cc and ee expands on that found in reference ff.

- ll. AFR 300-12, Procedures For Managing Automated Data Processing Systems (ADPS) Vol. II, 2 September 1977. (Unclassified)
- mm. AFR 300-15, Automated Data Systems Project Management, 16 January 1978. (Unclassified)
- nn. AFR 300-2, Managing the USAF Automated Data Processing Program, 24 April 1980. (Unclassified)
- oo. AFR 300-6, Automatic Data Processing Resource Management, 11 July 1980. (Unclassified)
- pp. AFR 178-1, Economic Analysis and Program Evaluation For Resource Management, 14 December 1979. (Unclassified)
- qq. AFP 178-8, Economic Analysis Procedures Handbook, 19 May 1981. (Unclassified)

1.3 Abbreviations and Acronyms.

| | | |
|--------|---|---|
| AAC | - | Alaskan Air Command |
| AB | - | Air Base |
| ADS | - | Automated Data Systems |
| AF | - | Air Force |
| AFIRMS | - | Air Force Integrated Readiness Measurement System |
| AFLC | - | Air Force Logistics Command |
| AFM | - | Air Force Manual |
| AFORMS | - | Air Force Operations Resource Management System |
| AFP | - | Air Force Pamphlet |
| AFR | - | Air Force Regulation |
| AFRES | - | Air Force Reserve |
| AFS | - | Air Force Station |
| AFWIS | - | Air Force World Wide Military Command and Control System Information System |
| ANG | - | Air National Guard |
| ATO | - | Air Tasking Order |
| CAMS | - | Core Automated Maintenance System |
| CAS | - | Combat Ammunition System |
| CCB | - | Configuration Control Board |
| CE | - | Civil Engineers |
| CFMS | - | Combat Fuels Management System |

| | | |
|----------|---|---|
| CSMS | - | Combat Supplies Management System |
| DDN | - | Defense Data Network |
| DoD | - | Department of Defense |
| DPI | - | Data Processing Installation |
| DRD | - | Data Requirements Document |
| DSDO | - | Data Systems Design Office |
| EA | - | Economic Analysis |
| E&I | - | Engineering and Installations |
| EDS | - | European Distribution System |
| EIFEL | - | NATO Command and Control System |
| EIG | - | Engineering Installation Group |
| EIP | - | Evolutionary Implementation Plan |
| FD | - | Functional Description |
| HQ | - | Headquarters |
| LAN | - | Local Area Network |
| LPP | - | Learning Prototype Phase |
| MAC | - | Military Airlift Command |
| MAJCOM | - | Major Command |
| NAF | - | Numbered Air Force |
| NATO | - | North Atlantic Treaty Organization |
| OPLAN | - | Operation Plan |
| OPR | - | Office of Primary Responsibility |
| PACAF | - | Pacific Air Forces |
| PCR | - | Programmed Communications - Electronics Requirement |
| PD | - | Product Descriptions |
| PMO | - | Program Management Office |
| POL | - | Petroleum, Oil and Lubricants |
| POM | - | Program Objective Memorandum |
| SAC | - | Strategic Air Command |
| SAM | - | Sustainability Assessment Module |
| SBSS | - | Standard Base Supply System |
| STD | - | Standard |
| TAC | - | Tactical Air Command |
| TAF | - | Tactical Air Forces |
| TASCFORM | - | Technique for Assessing Comparative Force Modernization |

- TFW - Tactical Fighter Wing
- USAF - United States Air Force
- USAFE - United States Air Forces Europe
- WIN - WWMCCS Intercomputer Network
- WIS - WWMCCS Information System
- WMP - War and Mobilization Plan
- WSAM - Weapon System Assessment Model
- WSMIS - Weapon System Management Information System
- WWMCCS - World Wide Military Command and Control System

SECTION 2. INTRODUCTION TO AFIRMS

This section provides a brief introduction to the Air Force Integrated Readiness Measurement System (AFIRMS). A more complete description is provided in the AFIRMS Functional Description.

2.1 AFIRMS Synopsis.

2.1.1 Key AFIRMS Concepts. AFIRMS is an automated, tasking based, capability assessment system. As such, AFIRMS evaluates unit and force capability to perform tasked missions based on the availability of specific resources.

- a. The conceptual requirements for AFIRMS are two-fold:
 - (1) Assessment of combat capability against specific tasking. The user can assess unit/force combat capability against any planned or ad hoc tasking, e.g., War Mobilization Plan (WMP), Operation Plan (OPlan), Fragmentary Order, Air Tasking Order (ATO), Contingency Plan, etc.
 - (2) Assessment of combat capability based on budget appropriations. AFIRMS provides a tool for computing long-term readiness and sustainability trends, spanning two to six fiscal years. This tool permits comparison of readiness and sustainability by fiscal year and can therefore highlight the impact of appropriation changes. Thus, changes in funding are related to changes in force readiness and sustainability. Also, senior Air Force decision makers are supported during budget deliberations and Air Force budget allocations.
- b. AFIRMS implementation has two key concepts:
 - (1) Integrated approach to tasking based capability assessments. AFIRMS has two integrative dimensions. First, all applicable resources and their usage interactions are considered. For example, in sortie capability assessment, AFIRMS evaluates capability in terms of all four essential resource types (aircrew, aircraft, munitions, fuel), their interdependencies, and their generative components (such as spares for aircraft, training qualifications for aircrew, load crews for munitions, and hot pits for fuel). Second, other automated systems (such as the Combat Supplies Management System (CSMS), Combat Fuels Management System (CFMS), Weapon System Management Information System (WSMIS), etc.) outputs are integrated into capability assessment calculations through system interfaces between those systems and AFIRMS.

- (2) **Data Quality Assurance.** Capability assessment is no better than the data upon which it is based. Therefore, AFIRMS emphasizes a user orientation toward quality assurance of source data. Unit and other data input level users are provided effective tools to accomplish their daily activities and therefore develop a vested interest in AFIRMS data currency and validity. Capability assessment data can then be extracted for use by higher or parallel users with maximum confidence in its validity.

2.1.2 AFIRMS Functions. Four basic AFIRMS functions combine to assess readiness capability:

- a. **Translate Tasking.** As a tasking based capability assessment system, tasking must be converted into a standard format recognized by AFIRMS. Tasking is defined in AFIRMS to the unit level and may consist of actual tasking, standard tasking, or contingency tasking. Any of these taskings can be defined within specified WMP or OPlan constraints, at the option of the user. Likewise, the tasking may be defined by the user for present, historic or future requirements.
- b. **Define Resources.** The resource definition function of AFIRMS ensures that information about inventory status is available and accurate. Wherever possible, this data is obtained by interface with other functional systems. As with tasking, resource information can be defined for actual, hypothetical, or contingency situations, either present, historic, or future.
- c. **Determine Ability to Perform.** Determining the force's ability to perform is the essential function of AFIRMS. The tasking and resource data are processed to determine how much of the specified tasking can be accomplished with the resources available. Ability to perform is evaluated in terms of the task metric (sorties, etc.) and the cost metric (dollars) to provide readiness/sustainability and dollars to readiness assessments.
- d. **Aggregate, Analyze and Present Data.** Aggregation, analysis and presentation ensure the proper grouping and display of data to provide useful information at the unit, major command and HQ USAF. Aggregation refers to the creation of a composite understanding of capability for several units.

2.2 AFIRMS Documentation. A set of nine types of documents describes AFIRMS. A list of these AFIRMS documents is provided below along with a short description of the particular aspects of AFIRMS which are addressed by each document.

- a. **Functional Description (FD).** The FD provides the description of AFIRMS concepts in user terms. It is the baseline document which ties the AFIRMS documents together.

- b. Economic Analysis (EA). The EA states AFIRMS estimated costs. It explains the cost factors of AFIRMS implementation alternatives and states the recommended alternative.
- c. Evolutionary Implementation Plan (EIP). The EIP details the current plan for AFIRMS implementation. It describes the time sequence of the implementation by functional blocks, organizations and work phases (analysis, development, installation, etc.).
- d. System Specification. The AFIRMS System Specification adds the design requirements to the functional concepts in the FD. It divides the system into subsystems (HQ USAF, HQ USAFE (MAJCOM), and Wing (unit)) and assigns functions required within each subsystem. The system specification details the overall architecture, intersite interface gateways, processing logic flows and the communications network specifications.
- e. Subsystem Specifications. There are three AFIRMS subsystem specifications: HQ USAF, HQ USAFE (MAJCOM/numbered Air Force), and the Wing (unit/squadron). Subsystem specifications detail the specific design and/or performance requirements of the system at that level. Design details cover the architecture, required functions, the functional users, intrasite interface gateways, and applicable processing logic flows.
- f. Database Specifications. There are three AFIRMS database specifications: HQ USAF, HQ USAFE (MAJCOM/numbered Air Force), and Wing (unit/squadron). These specifications describe the database architecture, size, and content, as well as logical data relationships for the functions performed at each of the AFIRMS levels.
- g. Data Requirements Document (DRD). The DRD identifies, categorizes, and groups the generic types of data used in AFIRMS. It also defines each type of AFIRMS data element (attribute class).
- h. Product Descriptions (PDs). The PDs visually portray the products which implement the AFIRMS functions as input and output tools.
- i. Transform and Model Descriptions. The Transform and Model Descriptions Document defines how AFIRMS calculates the output data from the input data. Specific algorithmic calculations are provided. Logical groups of algorithms forming AFIRMS models and transforms are described.

SECTION 3. EVOLUTIONARY IMPLEMENTATION PLAN OVERVIEW

3.1 Office of Primary Responsibility. The Readiness Assessment Group, HQ USAF/XOOIM, is the Office of Primary Responsibility (OPR) for managing the evolutionary implementation of AFIRMS. The U.S. Air Force Data Systems Design Office (DSDO) is the Program Management Office (PMO) and is responsible for the design, development, testing, and implementation of AFIRMS. The PMO also coordinates the efforts of the Air Staff and MAJCOM OPRs to ensure the user's requirements are implemented in AFIRMS.

3.2 Implementation Elements. The AFIRMS EIP is composed of segments, blocks, and phases. HQ USAF and each MAJCOM is a segment within the overall AFIRMS implementation. Each segment is composed of a number of blocks. A block is a specified set or subset of functional requirements to be implemented. These requirements are normally represented by a specific set of AFIRMS applications products (screens and processes), communications capabilities, and interface requirements. Each block is composed of five phases. The completion of the five phases implements the functional requirements identified for that block. The phases of a block contain the task detailing necessary for the analysis/requirements definition, development, installation, operation, and the integration/management of the functional block capabilities. Figure 3-1 shows the relationship between the segments, blocks, phases, and time. This figure shows that the EIP is composed of segments (Segment H = HQ USAF and Segment U = USAFE) which have functional capabilities implemented as sequential blocks over time.

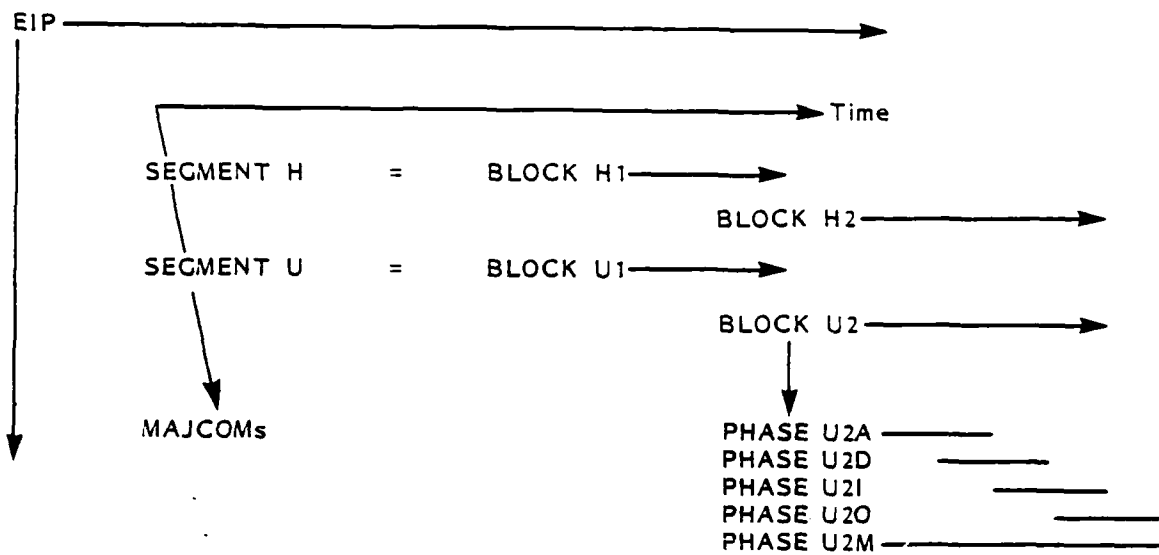


Figure 3-1. AFIRMS EIP Structure

- SEGMENT = The HQ USAF or a MAJCOM "slice" of AFIRMS. (HQ USAF and USAFE are the first two segments.)
- BLOCK = A module of AFIRMS functional capability. (Block I functionality for HQ USAF, and for USAFE = enhanced LPP functional capabilities.)
- PHASE = A group of tasks required to accomplish a block. (Analysis, Development, Installation, Operation, Integration/Management.)

The AFIRMS set of readiness and capability assessment tools available to each functional user are tailored to the work requirements and status information needs of that user. The evolutionary aspect of AFIRMS implementation has two meanings. Both meanings relate to time-phased sequences of activities. First, the implementation of the initial blocks of AFIRMS functional capability has a sequential timetable over the HQ USAF and the MAJCOMs. The initial block within each segment of the evolutionary implementation provides a core capability for the HQ USAF, MAJCOM headquarters, and operating units of each MAJCOM. The core capability may be different for Block I of each EIP segment since additional capabilities or enhanced capabilities will become

available over time. The core capabilities for the first segment implementations are those of the LPP as modified to reflect the lessons learned during LPP trials and tests. Second, the implementation provides for an upgrade of the core capabilities in subsequent blocks. These subsequent blocks provide additional functional capabilities beyond the core functions, accommodate changing missions or environments, and take advantage of improved data processing technology.

3.3 Schedule. In order to reduce the total implementation time required for AFIRMS, the block development efforts for several MAJCOM segments must occur in parallel.

An optimum schedule for implementation is shown in Figure 3-2. This schedule shows a sequencing of segments and of blocks within each segment. The schedule is unconstrained by resources and represents a maximum effort to implement all MAJCOMs simultaneously.

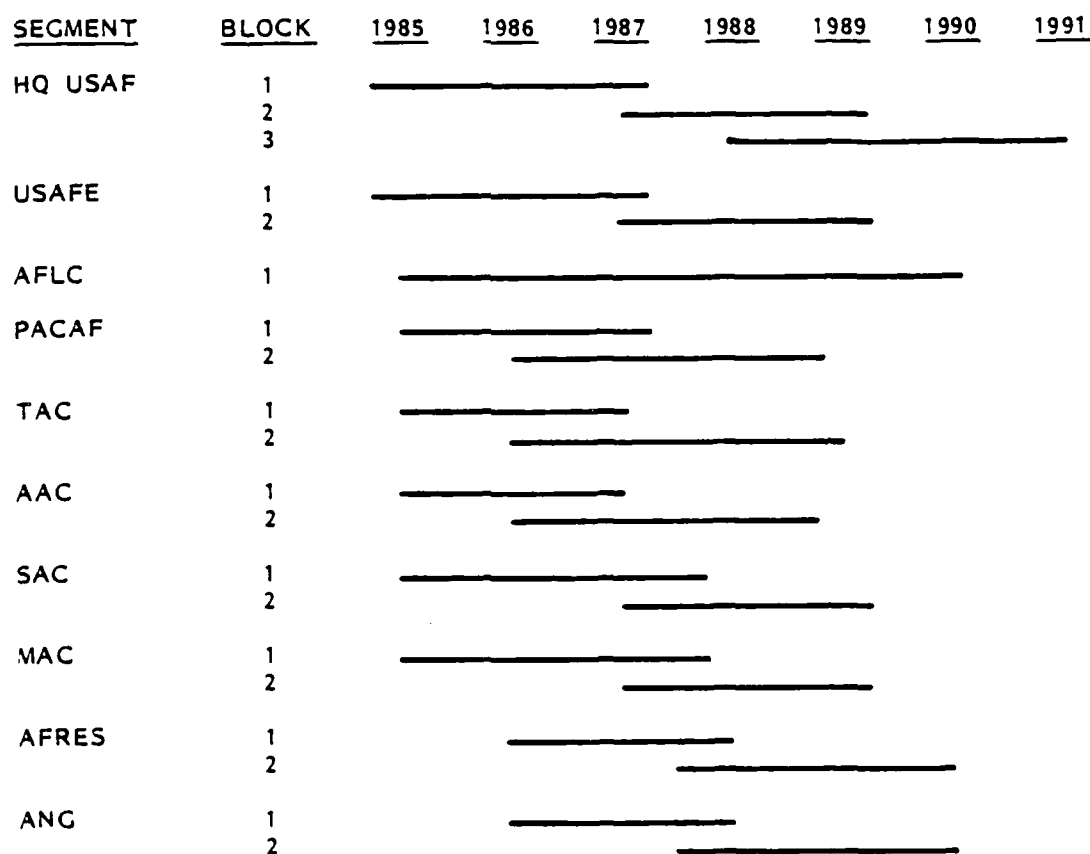


Figure 3-2. AFIRMS Master Implementation Schedule (Optimum)

The planned AFIRMS implementation schedule is shown in Figure 3-3. This implementation is constrained by program funding. It allows for identification of funding sources for the Air National Guard (ANG) and the Air Force Reserve (AFRES) segments. Depending on funding availability, the implementation schedules for these segments may be moved forward in time. Likewise, other MAJCOM funding initiatives could adjust schedules toward the "optimum" schedule shown in Figure 3-2.

| SEGMENT / BLOCK | | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|-----------------|---|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|------|------|------|
| HQ USAF | 1 | ████████████████████ | | | | | | | | | |
| HQ USAF | 2 | | | ████████████████████ | | | | | | | |
| HQ USAF | 3 | | | | | | ████████████████████ | | | | |
| USAFE | 1 | ████████████████████ | | | | | | | | | |
| USAFE | 2 | | | ████████████████████ | | | | | | | |
| AFLC-HQ | 1 | | ████████████████████ | | | | | | | | |
| AFLC-ALC's | 2 | | | ████████████████████ | | | | | | | |
| AFLC-HQ | 3 | | | | | | | ████████████████████ | | | |
| AFLC-ALC's | 4 | | | | | | | ████████████████████ | | | |
| PACAF | 1 | | | ████████████████████ | | | | | | | |
| PACAF | 2 | | | | | ████████████████████ | | | | | |
| TAC | 1 | | | ████████████████████ | | | | | | | |
| TAC | 2 | | | | | ████████████████████ | | | | | |
| AAC | 1 | | | | | ████████████████████ | | | | | |
| AAC | 2 | | | | | | | ████████████████████ | | | |
| SAC | 1 | ████ | | | | | | | | | |
| SAC | 2 | | | | | ████████████████████ | | | | | |
| MAC | 1 | ████ | | | | | | | | | |
| MAC | 2 | | | | | | | ████████████████████ | | | |
| AFRES | 1 | | ████████ | | | | | | | | |
| AFRES-TAC | 2 | | | | ████████████████████ | | | | | | |
| AFRES-SAC | 3 | | | | | | ████████████████████ | | | | |
| AFRES-MAC | 4 | | | | | | | ████████████████████ | | | |
| ANG | 1 | | ████████ | | | | | | | | |
| ANG-TAC | 2 | | | | ████████████████████ | | | | | | |
| ANG-SAC | 3 | | | | | | ████████████████████ | | | | |
| ANG-MAC | 4 | | | | | | | ████████████████████ | | | |

Figure 3-3. AFIRMS Master Implementation Schedule (Planned)

SECTION 4. SUMMARY OF EVOLUTIONARY IMPLEMENTATION

4.1 Segments of the Evolutionary Implementation Plan. The evolutionary implementation of AFIRMS is broken down into segments, blocks, and phases. A segment represents the implementation plan for AFIRMS at HQ USAF or at a MAJCOM. Each segment is composed of a number of blocks that represent a set or subset of functional requirements to be implemented. The blocks are broken down into phases; the phases represent the tasks necessary to implement the functional requirements of a block. HQ AFCC, in coordination with the Air Staff and MAJCOM OPRs, is responsible for the implementation of AFIRMS. The following tasks provide a framework within which implementation priorities can be set and progress monitored.

- a. Development and accomplishment of the AFIRMS Program Management Plan.
- b. Development and accomplishment of the EIP and its segment plans.
- c. Preparation and Update of the Data Project Plan.
- d. Development and accomplishment of the Configuration Management Program.
- e. Program Objective Memorandum (POM) and budget advocacy.
- f. Implementation scheduling.
- g. Supervision of the system developers (whether Air Force or contractor).
- h. Staff supervision of worldwide system operation and maintenance.
- i. Problem/action reporting.

4.2 Blocks of the Evolutionary Implementation Plan. A block is a specific set of AFIRMS functional capabilities. Blocks are defined in terms of statements of functional need, which are based upon the AFIRMS Functional Description. Functional needs may be readiness/sustainability assessment tools, interfaces with other MAJCOM/Air Force/DoD systems, or enhancements to these types of capabilities. Blocks are defined and scheduled in the AFIRMS Management Plan and are controlled by the Configuration Management Program.

Selection of functional requirements for implementation in a particular block in a specific MAJCOM segment is made from the list of unsatisfied requirements for that MAJCOM. This list of unsatisfied requirements will be compiled by the AFIRMS HQ USAF Office of Primary Responsibility (OPR) and the Program Management Office (PMO), from problem/action reports received from the MAJCOMs, from the set of available or projected AFIRMS products as they are developed and from specific statements of requirement from MAJCOM representatives.

4.3 Phases of Evolutionary Implementation Plan Blocks. A phase is one of five sets of actions necessary to achieve the functional capabilities of a block in the AFIRMS EIP. The five phases are Analysis/Requirements Definition, Development, Installation, Operations, and Integration/Management. These phases are not sequential but represent the logical flow of activities within a block. Activities of one phase may occur concurrently with activities of another phase.

4.3.1 Analysis/Requirements Definition Phase. The Analysis/Requirements Definition Phase consists of those steps necessary to design and specify, in detail, the functional needs for a block in the EIP. The completion of this phase results in the updating or development of system/subsystem specifications, database specifications, and supporting documents such as a Block Development Plan and a Block Test/Verification/Validation Plan. It also provides information to update the EIP, Economic Analysis, Transform and Model Descriptions, Product Descriptions, and the Data Requirements Document.

4.3.2 Development Phase. The Development Phase consists of those steps necessary to create the products that accomplish the functional needs for a block in the EIP. The completion of the Development Phase results in creation, and stand-alone testing, of the program coding necessary to accomplish the functional requirements. The Development Phase also provides the Training Program, Maintenance Program, Installation Program, and the user/operator documents required for the block implementation.

4.3.3 Installation Phase. The Installation Phase consists of those steps necessary to place the functional capabilities into operation. The completion of this phase results in the modification of facilities (if necessary), acquiring and placing communications lines and computer hardware into service, installing software, testing the system, changing operations to the new system, and conducting training.

4.3.4 Operations Phase. The Operations Phase consists of those steps necessary to operate and maintain the operational system. System maintenance (hardware, software, and database) is a prime concern during this phase. The completion of the Operations Phase is established by the implementation of a new block.

4.3.5 Systems Integration/Management Phase. The Systems Integration/Management Phase consists of those steps necessary to monitor and guide the block installation in accordance with the AFIRMS Management Plan. Actions in this phase are concurrent with the Analysis, Development, Installation, and Operations Phases. Actions in the Systems Integration/Management Phase result in control of the block implementation, preservation of system integrity, and in monitoring of the worldwide AFIRMS operations.

4.4 Systems Interface Candidates. AFIRMS interfaces are required with MAJCOM unique, Air Force standard, and DoD systems in order to collect the resource summary/status data necessary to produce the AFIRMS readiness assessment tools. These interfaces are also required in order to communicate between and within the Air Force organizational structure. Interfaces with communications systems, logistics management systems of the Air Force Logistics Command (AFLC), personnel management systems, and command/control (tasking) systems provide necessary AFIRMS data while minimizing data system redundancies. The plan for AFIRMS interface with other data systems is contained in the Systems Interface Program which is part of the AFIRMS Management Plan. Systems with which AFIRMS is likely to interface/integrate include:

SYSTEM

Air Force Information System
Architecture Efforts

Air Force Operations Resource
Management System (AFORMS)

INTERFACE AREA

AFIRMS architecture
and environment

Aircrew status

SYSTEM

Base Level Data Automation Program (PHASE IV)

Combat Ammunitions System

Combat Fuels Management System (CFMS)

Combat Supplies Management System (CSMS)

Contingency Operations/Mobility Planning and Execution System (COMPES)

Core Automated Maintenance System (CAMS)

Dyna-METRIC/Mini Dyna-METRIC Model

Electronic Information Command and Control System for Operational Readiness of the Luftwaffe (EIFEL)

European Distribution System (EDS)

Local Area Network Efforts (LAN)

Logistics Capability Measurement System (LCMS)

Standard Air Force Small Computer Requirements Contract Efforts

Standard Base Supply System (SBSS)

Technique for Assessing Comparative Force Modernization (TASCFORM)

War Mobilization Plan Update System

Weapon System Management Information System (WSMIS)

WW MCCS Information System (WIS/AFWIS)

INTERFACE AREA

Data integration

Munitions Status

Combat fuels inventory and status

Spares status

Tasking and force structure

Spares, maintenance support personnel status

Spares capability

Tasking and force structure

Spares status

Communications (local)

Spares status

Hardware

Spares, fuels, personnel status

Force modernization

Tasking and force structure

Spares capability

Communications (long-line)

The "ideal" interface posture for AFIRMS requires electronic interface with USAF support systems (particularly logistics support and tasking systems), DoD systems (particularly communications systems), and allied systems (tasking systems) in a multi-level security classification environment. These interfaces must be defined and controlled in order to be easily reconfigurable/relocatable. Such an approach to the interfaces accommodates changing force structure or changing beddown locations, and

facilitates reconstitution in case of battle damage or sabotage. There are impediments to implementation of an ideal interface posture for AFIRMS. For example, "stove-pipe" functional systems require tailored interfaces for each logical interface where file structures and inputs/outputs are embedded in applications and where non-standard data elements and codes are used. Also, information access policies which address security, privacy, copyright, data integrity, and evaluation/certification issues impede the ideal interface implementations.

A number of programs are working in the direction of standardization. In large measure, the progress of AFIRMS interface with other systems will hinge on the pace of the Defense Data Network (DDN), Automated Message Processing Exchange (AMPE), LANs, SCOPE EXCHANGE/DIAL, PHASE IV base-level automation, and other programs associated with the USAF Information System architecture. These efforts will form the ideal AFIRMS interface mechanism as other systems evolve to conform to the architecture.

Other efforts in standardization cover the areas of Database Management Systems (DBMS) and, in particular, a common data interchange format. The common data interchange format allows AFIRMS to be designed modularly, with generic interfaces that can communicate with current and future systems. The International Standards Organization (ISO) Standard 8211 (Data Descriptive File, DDF) and CCITT's Draft Recommendation (Presentation, Transfer, Syntax, and Notation) are two examples of data interchange formats that can be adopted as AFIRMS standards. All information passed to and from AFIRMS would be required to be in the standard data interchange format.

Since ideal interfaces between AFIRMS and other systems will not be available during the initial blocks of AFIRMS, interim interface solutions must be attempted in order to maintain momentum in implementing AFIRMS. At the HQ USAF and MAJCOM levels, interim interface with systems outside the headquarters is via AUTODIN, DDN, and/or WWMCCS/WIS. Within these levels, interfaces are hardwired.

At unit levels, interim interfaces with systems outside the AFIRMS are hardwired in controlled mode security operations. If controlled mode security is not available, interfaces to unclassified systems are air gap.

During Block 1 implementation, planning and design for Block 2 are conducted. Part of Block 2 planning includes a review of status of DoD and USAF Information System architecture implementation in order to capitalize on realized interface capabilities. For the next five years or so, AFIRMS will address each interface requirement ad hoc during the analysis phase of each block.

4.5 System Configuration Control. System configuration control incorporates those procedures necessary to establish and maintain a specified level of operational capability in the AFIRMS system. Three levels of configuration control are required to coincide with the three levels of operational control over AFIRMS activities: units (wings), MAJCOMs and/or Numbered Air Forces (NAFs), and HQ USAF.

Configuration control responsibilities of each level in the AFIRMS system are addressed in this section of each Segment Plan. Also, special control requirements relating to interfacing AFIRMS with other existing information systems are detailed. The specific role of configuration control in each of the implementation phases will be detailed separately in the appropriate section. The general requirements addressed in AFR 300-15, Chapter 2, serve as the basis for the development and continuing operation of the AFIRMS Configuration Management Program.

Details of the Configuration Management Program, including Problem/Action Reporting, are found in Appendix B of this document.

4.5.1 HQ USAF Configuration Control. Configuration management procedures incorporate provisions for the following:

- a. AFIRMS Configuration Control
- b. AFIRMS Baseline Management
- c. AFIRMS Interfacing Requirements/Status
- d. AFIRMS Auditing and Review Procedures
- e. Problem/Action Reporting System

The focus of control at the HQ USAF level is to define the minimum operating requirements for the entire AFIRMS system while providing operating flexibility to lower levels.

Change control procedures are in accordance with AFR 300-12, Vol II. An HQ USAF level Configuration Control Board (CCB) provides the focal point through which the applicability, approval, and timing of proposed changes is established. This board is composed of one member from the operations or readiness assessment office of each MAJCOM and one member of each major staff element participating in AFIRMS. The board is chaired by the AFIRMS OPR.

4.5.2 MAJCOM Configuration Control. The AFIRMS ADPS manager performs configuration management in conjunction with the DSDO. MAJCOM level configuration controls implement the HQ USAF configuration control requirements. MAJCOM level control procedures serve to monitor the procurement, installation, and operating activities of AFIRMS within the elements of the MAJCOM. These procedures isolate and document AFIRMS deficiencies and provide a mechanism for reporting these deficiencies to HQ USAF configuration control authorities for disposition and action. MAJCOM controls ensure that all hardware and software contractors providing AFIRMS related capabilities, adhere to the functional and product baselines established by the AFIRMS Configuration Management Program and that the AFIRMS system is operated and maintained in accordance with the baselines. Specific major command configuration control authority responsibilities are identified in the appropriate EIP Segment Annex.

4.5.3 Wing Configuration Control. The Data Processing Installation (DPI) Manager at Wing level ensures configuration control for AFIRMS. Wing procedures detail controls for the routine operation and maintenance of AFIRMS and ensure that functional and product baselines are maintained. Wing level control procedures isolate and document AFIRMS deficiencies and report these deficiencies to MAJCOM and DSDO configuration control authorities for disposition and action. Specific wing configuration control responsibilities are identified in the appropriate major command EIP segment annex.

SECTION 5. ANALYSIS/REQUIREMENTS DEFINITION PHASE

5.1 Survey Users. The Analysis/Requirements Definition Phase consists of those steps necessary to design and specify, in detail, the functional needs programmed for a block in the EIP. These steps are the identification or confirmation of metrics, the design of the functional architectures with associated cost benefit analysis, system design, installation planning, and preparation of specifications. Survey efforts identify functional users of AFIRMS, identify general functional requirements, accomplish the preliminary facilities survey, and facilitate communication between the systems developer and the end user(s) of the system. Visits to work locations are accomplished to gain first-hand knowledge of the users' requirements and their contextual environment. Upon arrival at the survey site, the analysts conduct an in-briefing to inform the AFIRMS project officer and other key personnel of the reason for the visit and the goals of the user survey. The analysts use whatever tools are necessary to survey the users. Examples are:

- a. The use of questionnaires. Questionnaires provide a means of collecting consistent sets of information from a large/number of people in a short period of time.
- b. Interviewing. Interview questions lead to discussions about the current and desired future systems, both formal and informal. The analysts interview a cross section of the personnel to get a good feel for the users' operation and the spectrum of user requirements.
- c. Review of Management Indicators. Organizations use a variety of indicators to assign tasking and measure productivity, capability, and performance. The analysts inventory those indicators carefully to determine their use, the source of data, methods of compilation, and relevance as possible AFIRMS metrics.
- d. Preliminary Analysis of the Facilities. The analysts note the working environment. Many operations are scattered among several locations. The analysts determine the method of communication and the interface requirements between operations occurring at separate locations. Preliminary identification of available facilities, power sources, air conditioning, and access routes is accomplished.

When the survey is finished, the analyst team leader conducts an exit briefing with the AFIRMS project office and key personnel within the organization.

5.2 Identify/Confirm Metric(s). During the survey of the users, the unit's standards or indicators that measure tasking and performance are identified. The rationale for the metric, the source(s) of information, and the use of particular indicators or standards by a higher headquarters are determined. Some metrics may be for local use only. Other metrics are passed to higher headquarters for consolidation, analysis, and decision support. Other indicators or standards may be used as productivity measures. These indicators or standards are of primary importance to AFIRMS. They integrate resource requirements to achieve the desired mission results. As an example, the metric for tactical air forces is the sortie. The sortie integrates the essential resource components of a mission (aircraft, aircrew, fuels, and missions). It also provides a focus for the application of generative resources (such as spares) which are elemental to providing the basic aircraft resource.

5.3 Design Functional Architecture. A functional analysis of all potential AFIRMS users determines how different types of resource data affect the capability of a Wing's mission, and how the different users (Wings, MAJCOMs, and the Air Staff) use the same data for their particular purposes. A structured, "top-down" approach is taken for the functional architectural design once the "bottom-up" requirements analysis has been accomplished. All functional areas are broken down to sub-functions in enough detail to describe the relevant activities. In examining a function, the analyst gives specific attention to the interfaces, both into and out of the functional areas. Analysis also determines the organization element which controls the various activities. Availability and sufficiency of both existing communications and existing automated data systems establish constraints and requirements for the functional architecture. The functional architecture design provides the framework for the development of system design, specifications, and database structures. Specific steps necessary for functional architectural design are described in subsequent subsections.

5.3.1 Select AFIRMS Products. AFIRMS Products, which have been developed, relate to:

- a. Unit and base level status information
- b. Wing level resource status summary
- c. Capability assessment model (sortie generation)

- d. Integrated resource capability assessment
- e. Individual resource capability assessment
- f. Dollar costing of resource allocations against requirements
- g. "Optimization" of dollar allocation among resources to maximize capability.

After the requirement analysis, the available AFIRMS products are reviewed to see if they can meet, or be modified to meet, the various functional requirements.

The functional architecture includes existing or modified AFIRMS products, if applicable. Use of those products reduces the system development time considerably and avoids duplication of development efforts.

5.3.2 Design Additional Products. The user survey(s) may identify new functional requirements for which AFIRMS products are not yet developed. As the user identifies requirements that have not been previously defined, the analyst will design application modules for the new products based upon thorough, detailed functional requirements analysis. It should be emphasized that these are NEW products which MAY be deferred for implementation in subsequent functional block product development phases.

The functional analysis that establishes the functional architecture will also identify HQ USAF or MAJCOM unique requirements. These command unique requirements are likely to be the primary source of new AFIRMS products. These new products are identified, designed, and specified to a level of detail that will allow program coding to proceed.

5.3.3 Define/Design Interfaces. Very few, if any, functional areas operate in isolation. During the survey of users, interfaces will become apparent. There are inter and intra functional interfaces. Intra functional interfaces are internal to AFIRMS or AFIRMS users/sites. An inter functional interface is one outside of AFIRMS. The inter functional interface links AFIRMS with other Air Force functional areas and/or other automated systems. While the user survey will uncover the obvious interfaces, less obvious interfaces may be identified in the design of the functional architecture, and detailed systems specification. These interfaces are documented, specified, and included in the

design of AFIRMS. The specifications identify the method of interface (air gap, tape-to-tape, hardwire) along with the impact which the interface development will have on both AFIRMS and the external system(s).

5.3.4 Define Functional Baseline. This is the contract between the user and developer. The functional baseline includes all the requirements identified in the user survey and requirements analysis efforts, to include the metrics and any new applications. To ensure the accuracy of the information, the baseline is certified by the HQ USAF and MAJCOM configuration control authorities before any development work starts. With baseline certification, the OPR/PMO team assumes responsibility for new block development. Any enhancement to the block functionality, change in requirements, or additional development efforts must be approved by the configuration control authorities.

5.3.5 Design/Size Database. Design of the AFIRMS segment database consists of three stages: conceptual design, logical design, and physical design. A complete understanding of the relationships that exist for all data in a segment is needed for the conceptual design. Next, the conceptual database design is mapped into a series of logical database designs from each different user's perspective. The physical design and implementation of this logical design follow, with the peculiarities of the chosen DBMS establishing essential guidelines as to the actual structure of the data.

The logical database design does not normally change within a MAJCOM segment unless new information has been gathered. From the outset, it should reflect similarities that exist in all MAJCOMs for maximum consistency from segment to segment. Minor changes to the database design and, correspondingly, to the software that accesses it, are to be expected.

Likewise, the logical designs should reflect as much similarity between segments as is possible. Here, even more variation is expected because of some of the fundamental differences that exist among MAJCOMs. For sites within a segment, excluding the MAJCOM Headquarters, there should be little, if any, change to the logical designs. That is to say, all wings typically have the same functional areas and, consequently, AFIRMS data requirements within those functional areas are the same. This assumption is probably accurate for the most part, but minor exceptions should be expected.

Within a MAJCOM segment, the physical implementation of each site's database is likely to vary depending on the priority of individual needs. Thus, the database is optimized with available DBMS tuning mechanisms to better support products favored at that site. A goal of these optimizations is that very little or no change need be made to existing AFIRMS software at that site.

The conceptual and logical database design stages of the AFIRMS database at any given site in a particular segment will occur in the Analysis/Requirements Definition Phase of the initial implementation. Known data requirements of all functional areas of each site are accommodated during this phase. Logical database changes can cause major database design modifications across the board. Likewise, switching from one DBMS to another cannot be readily accommodated. Modifications to the physical design of the AFIRMS databases within a segment, on the other hand, continue for tuning purposes and should pose no major problem.

Sizing estimates are gathered during each design stage, approaching more realistic numbers as the design progresses. A reasonable sizing estimate is achievable after the logical design stage, since all data requirements are defined. Once again, it is reasonable to suggest that the sizing estimates should not vary greatly from one site to another within a segment, unless one site possesses many more resources than others. After a particular DBMS is chosen for use within a segment, the most accurate database sizing estimate can be made since actual data storage needs can be assessed and the amount of software which accesses that DBMS can be better estimated.

5.4 Cost/Benefit Evaluation. The objective of the cost/benefit evaluation is to provide the block functional capabilities as economically as possible and to ensure that the block implementation is constrained by the budget as defined and refined within the Economic Analysis document and the Management Plan, Volume I - Program Administration. A Cost/Benefit Evaluation is performed for each segment and, if required, each block within each segment. The purpose of the evaluation is to document the major analysis steps for selecting the most cost-effective means of accomplishing the AFIRMS objectives. The first Cost/Benefit Evaluation of Block I implementation for each segment may be included in a Segment Cost/Benefit Evaluation document or it can be written as a

separate document. Regardless, the Block 1 Cost/Benefit Evaluation must agree with, and provide more detail to, the recommended alternative and costs selected in the Segment Cost/Benefit Evaluation. The Cost/Benefit Evaluations for succeeding blocks in each segment must accommodate prior Segment and Block Evaluations.

The length and level of detail in the Cost/Benefit Evaluation will depend on the total cost of the implementation alternatives and the level of approval required in AFR 700-series regulations. AFR 178-1, AFR 173-13, and AFP 178-8, guide the evaluation study methods and cost figures.

5.5 Design System. The system design is the definition of the relationship among the hardware and software components that accomplish the functions defined in the functional architecture. The functions of the DBMS, applications and communications software, and hardware (if appropriate) are decomposed into subordinate components modules. The hardware and software modules are defined in sufficient detail to produce the system/subsystem specifications. The decomposition of functions is accomplished using structured "top-down" techniques, which concentrate on data flow, control, and timing.

5.6 Define Installation Requirements.

5.6.1 Structures Affected. Buildings scheduled to house new or upgraded equipment, and specific room locations within the buildings, are identified in this section. Once the rooms are determined, the positioning of each piece of equipment within the room is detailed so that specific installation requirements can be determined; i.e., access plan, location of power plugs, physical altering of walls, ceilings, and floors, etc. These requirements are updated once the results of the site survey are available, and final determinations of site installation configurations are accomplished. Specific responsibility for structural modifications is assigned in this section of each Segment Plan.

5.6.2 Power/Communications/TEMPEST Requirements. The specific hardware placed in each room determines electrical power requirements and equipment layout plans due to possible TEMPEST spacing requirements. The power and TEMPEST requirements for a piece of hardware selected during the development phase may be determined by referencing the manufacturer's site preparation manual or similar document. These documents provide the voltage, amperage, and frequency requirements as well as any TEMPEST constraints which must be observed. Inter and intra site communications requirements are derived from the system design. Intra site communications depend upon the number of functional users at the site and the relationships between the AFIRMS products used by these functional areas. Inter site communications requirements for connectivity are to the higher level AFIRMS site, to the remotely located elements of the site organization, and to either the higher or the remote elements as backup connectivity. After individual requirements are identified, they are aggregated by room in order to detail requirements by building. These requirements are updated to reflect any approved changes to the installation configuration identified during the site survey. The final content of this section, in each Segment Plan, identifies, or provides reference to, the detailed electrical requirements for the installation, and assigns specific responsibility for achieving electrical/communications/TEMPEST actions necessary to the installation.

5.6.3 Air Conditioning Requirements. Typical air conditioning requirements may be obtained from manufacturers' site preparation manuals which are representative of the expected equipment. These requirements are specified for the main processor and other environmentally sensitive equipment, such as intelligent color graphics terminals. Combined-site air conditioning requirements are derived for use during the site survey. These requirements, as modified by the findings of the site survey, specify the air conditioning installation. Specific responsibility for air conditioning services is assigned in this section of each MAJCOM Segment Plan.

5.6.4 Site Surveys. Once the facility, power, air conditioning, and TEMPEST requirements have been determined, site surveys are accomplished. This must be scheduled with the appropriate Engineering Installation Group (EIG) or Information Systems Group well in advance of the planned installation date. The site surveys determine exactly what facility modifications are required to accommodate the hardware

configurations. Details such as equipment locations, power sources, electrical lines, communications lines, and air conditioners are confirmed. Site surveys must be scheduled well in advance in order to accommodate installation, communications, and TEMPEST lead times. Responsibility for site survey(s) is assigned in this section of each MAJCOM Segment Plan.

5.7 Prepare Test/Verification/Validation Plan. A Test/Verification/Validation Plan for the segment applicable to each functional block implementation provides the procedures by which AFIRMS implementations are certified. To certify the block implementation, a number of actions are required. After the site surveys have been completed and the system has been installed, each site's system is completely tested, both stand-alone and with other sites. The system software and its interfaces with other software modules, such as the communications software and the database, are tested and verified to ensure that they perform correctly. The communications lines between the various sites also are tested to verify that data update notifications are received when sent from other sites. Also, data transfer from Wing level to MAJCOM level and MAJCOM level to Air Staff level is verified over the actual communications lines. A test for system load is performed to verify the capacity under which the system can successfully run. In addition, time tests are taken to verify compliance with data transaction speed requirements for each site. Tests involving power fluctuations and alternate power sources are performed to verify the prevention of system loss due to failure or inadequacy of backup power sources. Security tests and evaluations are integral parts of the Test/Verification/Validation Plan.

5.8 Prepare System/Subsystem Specifications. Once the analysis/requirements definition and system design have been completed, and the functional requirements for AFIRMS have been identified, they are set forth in system, subsystem, and database specifications. These technical documents detail the requirements to be satisfied by the block implementation effort.

The system specification (B-level) ties together the various subsystems, and defines system/subsystem/external interrelationships and interfaces. The system B-level specifications are for systems-wide requirements such as communications protocols and intersite interface gateways. Subsystem and database specifications are written (or

updated) for each system implementation site. These are B-level specifications. These specifications are prepared for development personnel, and thus detail the environment and design elements. Program specifications (C-level) are provided as annexes to the subsystem specifications. All system/subsystem/database specifications are prepared in accordance with appropriate Air Force Automated Data Systems (ADS) Documentation Standards.

The system/subsystem/database specifications provide a summary of the system/subsystem/database characteristics and requirements. They contain a description of the system/subsystem as well as qualitative and quantitative descriptions of how the system/subsystem functions satisfy user requirements. In addition, the specification documents furnish descriptions of the following:

- 1) The equipment (existing as well as new equipment to be procured) required for the operation of the system/subsystem.
- 2) The support software (and test software, if required) with which the computer programs to be developed must interact.
- 3) The interfaces with other applications computer programs.
- 4) System security considerations such as the levels of availability, integrity, and confidentiality of the system and its components.
- 5) A presentation of overall system/subsystem controls.
- 6) The operating procedures of the system.
- 7) The logical flow of the system/subsystem.
- 8) System inputs, output and database.
- 9) The functions of the computer programs in the system/subsystem.

SECTION 6. DEVELOPMENT PHASE

The Development Phase consists of those steps necessary to create the specified products that accomplish the functional needs programmed for a block in the EIP. These development steps are applications development, systems software development, and systems documentation development.

6.1 Develop Applications Software. Applications development includes adapting existing AFIRMS products, developing entirely new AFIRMS products, and unit-testing the resulting code. When the functional requirements of a block development can be satisfied by existing AFIRMS products or by modification of existing products, the development effort is reduced. The AFIRMS application software is developed in logical steps. The development steps include defining the program logic, writing the software pseudo code, transferring the pseudo code to actual code, making the code syntax error-free, linking the code with any external files or libraries, debugging the module (removing the logic errors), unit-testing the module, and finally integrating the module into the system and performing system tests.

6.2 Develop/Integrate Systems. This task is an overview of the entire development phase. The sub-tasks require an integrated view of the requirements and development process.

6.2.1 Cost/Benefit Evaluation. Detailed applications software design will depend on knowing the characteristics of the operating system, hardware, DBMS, or system utilities. Therefore, a cost/benefit evaluation must be accomplished early in the development phase. The effort to make final determination of the hardware and software for development and implementation must be done in a manner similar to a standard economic analysis, as described in AFR 178-1 and AFP 178-8. Detailed research into the performance of potential hardware and software must be considered from the perspective of costs and benefits, despite the human tendency for this effort to concentrate solely on the technical merits of products that are readily available. Thorough research documents as wide a range of alternatives as possible. Software design and pseudo-coding will then proceed, before the hardware and systems software are acquired.

General procedures are as follows:

- a. Determine constraints imposed by requirements and Air Force/AFIRMS standards.
- b. Determine performance requirements of unconstrained system and/or components.
- c. Research and assess available hardware and software products, particularly those available from Air Force or DoD standard procurements, including the study of technical articles and the interviewing of product users.
- d. Determine development task load, development schedule, and operations and maintenance requirements associated with each alternative.
- e. Document costs/benefits analysis and selection.

Since the hardware and software components perform, as a whole, to provide the functions and system support required by the application, the performance requirements of the components must be kept in the perspective of their contribution to the whole system. Where the specific choice of components is not constrained, the evaluators are free to try many alternatives for the most cost-effective life-cycle system performance.

6.2.1.1 Select Hardware/Operating System. If not explicit in the requirements documentation produced at the end of the analysis/requirements phase, the performance requirements of the hardware and operating system must be defined. System simulation tools are advisable to aid in this effort, and such tools may be available from the analysis/requirements phase. Characteristics and performance criteria of the hardware and operating system considered are:

- 1) Computer and Peripherals
 - a. Central processing unit throughput
 - b. Main memory size and access timing
 - c. On-line disk capacity and timing
 - d. Environmental, electrical, and security characteristics
 - e. Available operating systems

- f. Life-cycle maintenance and support, including future modifications and enhancements
 - g. Life-cycle cost efficiency in view of changing technology.
- 2) Operating System
- a. Size and speed/overhead
 - b. Maturity/stability
 - c. Compatibility with security requirements
 - d. Availability of compatible DBMS and utilities
 - e. Compatibility with multiple types of hardware
 - f. Life-cycle maintenance and support, including future modifications and enhancements
 - g. Life-cycle cost efficiency in view of changing technology.

6.2.1.2 Select Database System. The following characteristics are examined:

- a. Read and write performance
- b. Data synchronization and file lockout
- c. Security characteristics
- d. Interfaces to programming languages, operating system, and network software
- e. Ease of database expansion and schema changes
- f. Life-cycle maintenance and support, including future modifications and enhancements
- g. Life-cycle cost efficiency in view of changing technology.

6.2.1.3 Select System Utilities. System utilities include the following:

- a. Network software
- b. Graphics utilities
- c. Compilers and debuggers
- d. Structured design aids
- e. Electronic mail.

Because of the wide variety of tools in this category, the evaluation assigns weights of importance to each component, based on the cost impact of the item. The importance of certain features of individual components is weighed against the cost of having the development team work without the item or develop its own.

6.2.2 Integrate Systems Code. The applications and systems code is written in a structured, top-down, design manner, properly commented, to facilitate the necessary on-paper walkthroughs, and stand-alone testing. The code is then integrated with the rest of the system. The structural top-down design of the software and the appropriate walkthrough checks are quality assurance mechanisms which help it identify problem areas for resolution prior to implementation. Code integration consists of syntax and logic error removal, compilation, and linkage with any system routines and library files or software modules. External interfaces are linked to the system code within software modules (separate spawned processes), library files or library routines, and external (i.e., non-AFIRMS) systems.

6.2.3 Conduct System Developmental Tests. After all the application modules are separately tested and integrated into the total system, the total system must be thoroughly tested. Successful entry into the system must be made properly. User login security, the main processor(s), communication links, and each application module must be further tested within the total system environment. User access rights by type of access (read, write, delete, etc.) must be verified. All interfaces between modules are tested. Data input and output processes are verified. Data update processing messages are checked. Database updates are successfully accomplished. Proper exit of the system must be tested.

6.2.4 Establish Product Configuration Baseline. Once the system code and external interfaces are integrated into the system and sufficient testing has been performed, a baseline version of the system is produced for incorporation at all affected user sites at the HQ USAF, MAJCOM, and Wing levels. The system baseline is mandatory

for consistency throughout all AFIRMS sites and for understanding problem/action reports. This baseline system must be formed from the AFIRMS core system, where all modifications/developments occur. The baseline version reflects the current operational state of the system; it contains the current modifications made to the system. Each version of the baseline system is appropriately labeled with version number, date of issue, and any specific characteristics of that baseline version.

6.2.5 Establish Problem/Action Reporting System. In order to record possible deficiencies with the system or to record modifications that system users request, a problem/action reporting system is contained within the AFIRMS configuration control system. The reporting system is an integral part of the AFIRMS system software, designed and developed for this purpose. The reporting system consists of procedures through which the user can specify his/her requests or problems. These procedures are directly linked with a file on the system within which the information can be stored for later review by the AFIRMS system developers. The user manual clearly and concisely states these procedures. The manual explains the interface between the AFIRMS system and the problem/action reporting system. It also explains how to enter and exit from the reporting system. The information received from the users via this utility can then be incorporated into the AFIRMS system development plans in an organized manner.

6.3 Develop System Documentation.

6.3.1 Prepare Training Plan/Manual(s). The timing of the training is important to ensure that the user is prepared to operate the system once the hardware has been delivered, software uploaded, and the system checked out. A training plan is required that specifies training responsibilities (MAJCOM or Air Training Command) and training schedules; includes a course syllabus; and identifies training duration, location, and instructional aids necessary to teach the course. Classroom instruction with maximum "hands-on" use of the new system is desirable for the initial training. This reduces student apprehension and gains user acceptance of the new hardware/software. If Air Training Command (ATC) is to be responsible for training, ATC must be brought into the development effort early to ensure that instructors are available to prepare the training program. In this situation, the MAJCOM retains responsibility for training administrative actions, such as preparing training schedules, arranging for classrooms and, if possible, consolidating training among several AFIRMS sites.

6.3.2 Prepare User/Operator Manuals. Manuals are probably the most important documents the system developer produces. After the user has been trained and the system installed, the user/operator manuals guide the system operation. Newly assigned personnel may initially rely solely on the manuals to learn how to operate the system. The manuals start with instructions on how to turn equipment on and off. The manuals contain simple instructions for operating AFIRMS at the MAJCOM or Wing level. Operating procedures for the system software and hardware products are provided as a combination of vendor-provided documents and AFIRMS user manuals. The vendor-supplied documents detail hardware and system software procedures, while AFIRMS user manuals detail functional product procedures including communications and security. The manuals are written in sufficient detail to enable the system user to respond to most situations he/she may encounter. The writer of the manuals should assume that the user's knowledge of automation is minimal.

6.3.3 Prepare Maintenance Plan/Manuals. Once the system becomes operational, it must be maintained. A system maintenance plan specifies the maintenance functions that must be performed, equipment required for these functions, a schedule for specified maintenance, and responsibilities for training operators. An accompanying manual lists *maintenance procedures in detail* for the technician's reference. The manual is divided into volumes to provide clear, concise instructions for AFIRMS system maintenance at the HQ USAF, MAJCOM, and Wing levels. Maintenance procedures for both hardware and software are addressed as a combination of vendor and AFIRMS supplied documentation. The vendor-provided documentation details hardware and system software maintenance procedures, while AFIRMS documentation includes functional product maintenance such as data backup and communications and security software recovery. The documentation provides sufficient detail so that the system operator can respond to most situations he/she may encounter. The documentation assumes that the operator's knowledge of the system is minimal.

6.3.4 Finalize System Program Documentation. When the system passes all its tests, final modifications need to be made to the documentation before it is released. All documentation must accurately reflect the system as actually built. This particularly applies to the system, subsystem, and product specifications since these documents, along with the database specifications, form the system or subsystem baseline.

SECTION 7. INSTALLATION PHASE

The Installation Phase consists of those steps necessary to place into operation those functional capabilities programmed for a block of the EIP. The installation steps are the modification of facilities; installation of communications/hardware/software; conduct of training; and problem reporting. These steps implement the Installation Plan prepared during the Development Phase based upon requirements identified during the site surveys of the Analysis Phase. These steps are to prepare the facility, acquire hardware, install hardware and software, train users on system operations, and report problems and desired changes after the system is operational. Responsibilities for the installation actions are assigned for these actions in the Segment Plans for HQ USAF and each of the MAJCOMs.

7.1 Installation Procedures and Schedule. Upon completion of the site survey, the schedules for the procurement of needed supplies, electrical work, communications links, and facility modifications are developed. These schedules are synchronized with the procurement of equipment, delivery of equipment, and the rest of the installation actions, such as software installation and training in a master implementation plan. Responsibility for establishing and accomplishing the installation schedules is assigned when the schedules are established. Since the schedules were established during the Development Phase, they are first verified and updated early in the Installation Phase. Also, some of the more drastic facility modifications can be initiated during the final efforts of the Development Phase.

7.1.1 Facility Modification. Before hardware or communications equipment can be fully installed, the facilities must be modified as specified in the site survey.

7.1.2 Communications Lines Installation. The schedule for running communication's lines can overlap the end of facility modification schedules, but a functional area cannot receive its lines until all physical modifications have been performed at that functional area's location and at the central node location. Ideally, the communications lines installations are completed at the same time as any room modifications are done.

7.1.3 Hardware Installation. Hardware cannot be installed and unit-tested at a location until the physical modifications, if any, are completed at that location. Once the communications equipment has been installed, a more complete test of the hardware can be performed.

7.1.4 Software Installation. Once the hardware has been installed, the software can be loaded and unit-tested. Since each functional area workstation contains its own database, the software can be loaded and tested on the workstation prior to the installation of the communications lines, if necessary.

7.1.5 Systems Integration. After all of the functional area workstations have been tested individually, and all of the intrasite communications lines have been tested, the subsystem is ready to be integrated and tested as a whole. Once this testing is completed, the installed subsystem is ready to be integrated into the AFIRMS system. The user can test intersite communications and intersite functions, such as roll-up.

7.2 Conduct Training Operations. Prior to, or concurrent with, systems installations, the *appropriate personnel at each location must be trained in its use.* Hardware maintenance training is provided when Air Force personnel are assigned responsibility for hardware maintenance. Final arrangements for post-installation assistance are made during an initial period of system operation.

Training required includes bringing the system up or down, including accomplishing cold or warm starts and how to recognize system hardware problems or how to recover from hardware errors which might occur during processing. Use of specific peripherals such as tape drives, console printers, line printers, screen printers, and special color printers, video projectors, and terminals is required.

Training in the functional capabilities and use of the system is also accomplished. This training includes identification of each of the functions in the system and their relationships.

Training on the use of communication devices such as modems or fixed plant adaptors is required. In addition, training must include instruction for proper keying and operation of encryption devices as well as establishing the schedule and procedure for keying.

SECTION 8. OPERATIONS PHASE

The Operations Phase consists of those steps necessary to operate and maintain the operational system.

8.1 System Maintenance. Maintenance of the AFIRMS hardware and software is the joint responsibility of the Air Force Data Systems Design Office (DSDO), the base, and the MAJCOM in which the hardware is installed. Maintenance difficulties, or improvements to maintenance procedures, are reported via the Problem/Action Reporting System (AFR 300-2, AFR 700-1).

8.1.1 Software Maintenance. Because AFIRMS is an Air Force standard system, all software maintenance is the responsibility of the Air Force DSDO. Any software changes to AFIRMS will be made in accordance with AFM 300-12, Vol. II, and released to the users by the DSDO.

8.1.2 Hardware Maintenance. Hardware maintenance will be the responsibility of the Air Force Data Processing Installation (DPI) manager at whose base the hardware is located. The terms of the equipment purchase may specify vendor-provided maintenance, in which case the preventive and remedial maintenance will be provided by the vendor. Alternatively, maintenance support may be provided by DPI personnel or done by third party contract. The DPI will administer the hardware maintenance program in accordance with AFR 300-6 for the MAJCOM- or Wing-level AFIRMS.

8.2 Problem/Action Reporting. Any AFIRMS software difficulties will be reported in accordance with applicable directives by the MAJCOM or Wing DPI to the DSDO Field Assistance Branch which then takes the necessary action to solve the problem, makes immediate message changes if necessary, and incorporates the changes into the next major release of the system to worldwide users. Major changes to a system must be approved by the Configuration Control Authority for placement in a particular implementation block of the Segment Plans for the affected major commands (AFR 300-12, Vol. II).

SECTION 9. SYSTEMS INTEGRATION/MANAGEMENT PHASE

The System Integration/Management Phase consists of those steps necessary to monitor, guide, and control the block implementation, preserve system integrity, and monitor worldwide AFIRMS operations. (Details of the System Integration/Management Phase are to be developed in conjunction with the AFIRMS Management Plan (Appendix B) during the period 6 June through 30 September 1985. Included in this Phase are the actions needed to test and incorporate new concepts after the implementation begins.)

ANNEX A. AFIRMS MANAGEMENT PLAN

The Management Plan is scheduled to be developed and published during the operational decision phase; 6 June through 30 September 1985.

The Management Plan addresses the responsibilities for planning, funding, and controlling blocks of AFIRMS functionality, whether contracted or in-house. This plan defines/programs the blocks of AFIRMS implementation by identifying the MAJCOM, level of resolution for resource/tasking information input to assessment algorithms, and external system interfaces required. The block, or phases of a block, as appropriate, define the unit of effort in the management plan. The plan also specifies how the testing and incorporation of new concepts will be handled after the beginning of AFIRMS implementation.

The management plan consists of a set of volumes, each of which addresses a specific aspect of AFIRMS management. These volumes are:

| <u>Volume</u> | <u>Subject</u> |
|---------------|----------------------------------|
| 1 | Program Administration |
| 2 | Security Program |
| 3 | Configuration Management Program |
| 4 | Systems Interface Program |
| 5 | Training Program |
| 6 | Maintenance Program |

APPENDIX A. SEGMENT IMPLEMENTATION SCHEDULE

| SEGMENT/BLOCK | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|---------------|------|------|------|------|------|------|------|------|------|------|------|
| ***** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** | **** |
| HQ USAF 1 | addA | ADDI | IIII | I000 | 00 | | | | | | |
| HQ USAF 2 | | AA | AADD | DDII | I000 | 0000 | 0000 | 0000 | 0000 | 0 | |
| HQ USAF 3 | | | | | | IIII | IIII | IIII | IIII | I000 | |
| USAFE 1 | aadA | AADD | DIII | 0000 | 00 | | | | | | |
| USAFE 2 | | AA | AADD | DDII | II00 | 0000 | 0000 | 0000 | 0000 | 0000 | |
| AFLC-HQ 1 | | A | AADD | DIII | I000 | 0000 | 0000 | 0000 | 0000 | | |
| AFLC-LCCs 2 | | | AA | AADD | DDII | II00 | 0000 | 0000 | | | |
| AFLC-HQ 3 | | | | | | | II | IIII | IIII | 0000 | |
| AFLC-LCCs 4 | | | | | | | II | IIII | IIII | 0000 | |
| PACAF 1 | | | A | AADD | DDII | I000 | 0 | | | | |
| PACAF 2 | | | | | A | AADD | DIII | 0000 | 0000 | 0000 | |
| TAC 1 | | | A | AADD | DIII | 0000 | | | | | |
| TAC 2 | | | | | AA | AADD | II00 | 0000 | 0000 | 0000 | |
| AAC 1 | | | | | A | AADD | DIII | 0000 | | | |
| AAC 2 | | | | | | AA | ADDD | II00 | 0000 | | |
| SAC 1 | aA | | | | | | | | | | |
| SAC 2 | | | | | A | AADD | IIII | 0000 | 0000 | 0000 | |
| MAC 1 | aA | | | | | | | | | | |
| MAC 2 | | | | | | AA | ADDD | DIII | I000 | | |
| AFRES 1 | | AA | A | | | | | | | | |
| AFRES-TAC 2 | | | | AAD | DIII | I000 | 0000 | 0000 | 0000 | 0000 | |
| AFRES-SAC 3 | | | | | AAD | DDII | II00 | 0000 | 0000 | | |
| AFRES-MAC 4 | | | | | | | AADD | DIII | I000 | | |
| ANG 1 | | AA | A | | | | | | | | |
| ANG-TAC 2 | | | | AAD | DIII | I000 | 0000 | 0000 | 0000 | 0000 | |
| ANG-SAC 3 | | | | | AAD | DDII | II00 | 0000 | 0000 | | |
| ANG-MAC 4 | | | | | | | AADD | DIII | I000 | | |

- Notes:
1. Lower case letters indicate current work under the LPP contract or work programmed for the LPP transition phase (a = analysis, d = development). Upper case letters indicate additional work required for implementation of operational AFIRMS (A = Analysis, D = Development, I = Installation, O = Operations).
 2. AFLC Block 4 and HQ USAF Block 3 are continuing systems integration implementation efforts that incorporate interface requirements of other major commands.
 3. Integration/Management Phases for each segment/block run concurrently with the four phases shown for each block above.

APPENDIX F. HQ USAF SEGMENT PLAN

SECTION 1. GENERAL PURPOSE

This appendix to the EIP provides the direction for implementing AFIRMS at HQ USAF. This appendix, along with the basic EIP, provides the specific organization, detailed schedules, and responsibilities for work required to implement AFIRMS. The reader should refer to the basic EIP for background information, overall schedules, and general system analysis/development guidance. The HQ USAF appendix to the EIP is intended to be a "living" document, and is updated periodically to reflect the current HQ USAF AFIRMS implementation planning.

SECTION 2. EVOLUTIONARY IMPLEMENTATION PLAN OVERVIEW

2.1 Implementation Elements. The HQ USAF AFIRMS Segment Plan is composed of a number of blocks, each with a set of phases. Each block is a specified set or subset of AFIRMS functional products which, when implemented, provide a specific level of ability within the AFIRMS functional capabilities. AFIRMS products are computer programs which accomplish specific processes at a specified level of detail, within a basic AFIRMS function. A block of AFIRMS products is implemented by the accomplishment of specific actions within five phases. These phases are:

- a. Analysis/Requirements Definition
(Results in completion of subsystem specifications)
- b. Development
(Results in completion of integrated/tested program coding)
- c. Installation
(Results in site installations of hardware and software)
- d. Operations
(Results in use of the installed block capabilities)
- e. Systems Integration/Management
(Results in coordinated accomplishment of all phases of the block in adherence to the AFIRMS Management Plan)

2.2 Schedule. The HQ USAF implementation plan for Block I will be completed during the analysis/requirement definition phase for Block I.

SECTION 3. ANALYSIS/REQUIREMENTS DEFINITION PHASE

3.1 Survey Users. Initial user surveys were performed during the LPP. The primary user identified is the Readiness Assessment Group (XOOIM). Additional user survey effort is required to identify/confirm additional users, such as:

- a. Logistics Readiness Center and/or Air Staff Logistics
- b. Personnel Readiness Center
- c. Contingency Support Staff
- d. Air Staff Planning

3.2 Identify/Confirm Metric(s). The capability assessment metric for HQ USAF Block I is the sortie. Therefore, the capability assessment function of HQ USAF Block I is limited to the fighter/reconnaissance units for which the sortie is the metric of existing AFIRMS capability assessment algorithms. Metrics for other types of units have not yet been confirmed. MAJCOM segment implementations will define additional metrics, as appropriate, for incorporation into subsequent blocks of the HQ USAF Segment Plan.

3.3 Design Functional Architecture. The design of the HQ USAF Block I functional architecture is intended to provide for consolidation and refinement of the functional capabilities of the LPP. The focus is on user interface, system reliability, error handling, user documentation, and others which are necessary to turn the HQ USAF prototype architecture into an operational system architecture reflecting the lessons learned during the LPP. This approach provides basic AFIRMS capabilities to HQ USAF as quickly as possible and establishes a sound foundation for the evolution of the HQ USAF segment of AFIRMS.

3.3.1 Select AFIRMS Products. HQ USAF Block I requires the implementation of AFIRMS products to provide:

- a. Unit and base level status information.
- b. Wing resource status summary.
- c. Sortie generation model.
- d. Integrated resource capability assessments.
- e. Individual resource capability assessments.
- f. Dollar costing of resource allocations against requirements.

The operational HQ USAF AFIRMS products providing these capabilities are essentially those developed and refined during the LPP. Design details for those functional products are specified in the HQ USAF Subsystem Specification, together with the product descriptions and relevant models/algorithms referenced therein.

HQ USAF Block 2 requires the implementation of AFIRMS products to provide dollar optimization of resource allocations against taking resource requirements. A new HQ USAF Subsystem Specification or a supplement to the specification, is required for each subsequent block implementation.

3.3.2 Design Additional Products. Requirements, if any, for additional products depend upon the results of the remaining user surveys. The intent for Block 1, is to limit evolution of new products and focus more on accommodating incremental requirements with adjustments to existing products. Entirely new product requirements identified will be designed and implemented within Block 2.

3.3.3 Define/Design Interfaces. HQ USAF AFIRMS Block 1 will interface with WWMCCS and DDN/AUTODIN for communications with MAJCOMs. No other system interfaces will be included in HQ USAF Block 1.

HQ USAF AFIRMS Block 2 will interface with Air Force functional systems identified during the Block 1 Analysis Phase. Existing systems such as the Wartime Sortie and Flying Hour Model are likely interface candidates.

3.3.4 Define Functional Baseline. The functional baseline for HQ USAF Block 1 is an enhanced version of the LPP functional capabilities. HQ USAF Block 1 requires few, if any, products in addition to those developed during the LPP. However, several LPP products require enhancements in order to more closely fulfill specific HQ USAF needs.

In addition, system architectural enhancements are necessary for the operational system. The more significant enhancements are of three types:

- a. Correct capability assessment shortcomings inherent to existing sortie generation model algorithms. Level of detail is increased somewhat over that of the LPP level of resolution for the same four basic resource categories: type of aircraft (from MD to MDS), type of aircrew (from MD to MDS), type of fuel (from a single type, JP4, to multiple types). For type of munitions, the resolution remains at the multiple types of "whole round" levels.
- b. Generalize AFIRMS product parameter selection mechanisms. (Dynamic definition of product parameter choices integrated with user file management and control tools.)
- c. Integrate the components of the Tasking Model to ensure integrity and consistency of tasking translation data elements. (Automate the user requirement to ensure tasking component consistency.)

These, and other requirements of the operational system, are detailed in the HQ USAF Subsystem Specification.

3.3.5 Design/Size Database. HQ USAF Block I database architecture will remain centralized on the existing minicomputer in the Readiness Assessment Group (XOOIM). All HQ USAF user data needs will be served by this central database. Specific design and sizing of the HQ USAF database is described in the HQ USAF Database Specification.

3.4 Define Alternative Architectures. The feasible alternatives identified in the Economic Analysis, Annex A, for HQ USAF are summarized as follows:

- a. LPP enhanced architecture, dedicated communications, with additional user functions.
- b. LPP enhanced architecture, WWMCCS/AUTODIN communications, no additional user functions.
- c. LPP architecture (minimal "fixes" only, no enhancements), WWMCCS/AUTODIN communications, no additional user functions.

3.5 Cost/Benefit Evaluation.

COSTS

| <u>ALTERNATIVE</u> | <u>ANALYSIS</u> | <u>DEVELOPMENT</u> | <u>EQUIPMENT</u> | <u>COMM</u> |
|--------------------|-----------------|--------------------|------------------|-------------|
| a | high | high | high | high |
| b | medium | medium | low | high |
| c | low | low | low | low |

BENEFITS

| <u>ALTERNATIVE</u> | <u>MOMENTUM</u> | <u>SATISFY USER(S)</u> | <u>RESPONSIVENESS</u> |
|--------------------|-----------------|------------------------|-----------------------|
| a | low | high | high |
| b | medium | medium | medium |
| c | high | low | low |

3.6 Design System. The recommended alternative from the AFIRMS Economic Analysis is alternative b. Thus, the HQ USAF Block 1 operational system builds upon the LPP system design. The hardware system consists of the existing (LPP) equipment plus additional line printers and dumb terminals (if any) as identified in the final user surveys. The software system consists of the *LPP products (corrected and enhanced)* to the functional baseline defined in the Development Phase. The detailed HQ USAF Block 1 system design is specified in the HQ USAF Subsystem Specification, HQ USAF Database Specification, Product Descriptions, and Transforms and Model Descriptions referenced by these specifications.

3.7 Define Installation Requirements. Block 1 installation requirements are basically completed. The hardware to support the LPP is in place and forms the kernel hardware suite for Block 1 of HQ USAF operational AFIRMS. The user survey may identify additional requirements, such as additional terminals, that are to be incorporated into existing hardware architecture.

Block 2 may require additional equipment and communications lines to connect with the Air Force Data Services Center. This will be confirmed in the Block 2 phases.

3.7.1 Structures Affected. Block 1 equipment is installed and operating. There is no effect on a structure, other than securing a place for the hardware and operator.

3.7.2 Power/ Communications/TEMPEST Requirements. Block 1 basic power/TEMPEST requirements have been identified and provided for the HQ USAF site. Block 2 may require additional communications/TEMPEST equipment. Communication requirements to interface with the first major command implementations are identified during the Analysis Phase of the first implementation blocks. Intrasite and external systems interface communications requirements must also be identified in the Analysis Phase. Block 2 installation phase will determine additional requirements.

3.7.3 Air Conditioning Requirements. Air conditioning is adequate to meet most Block 1 hardware requirements. The hardware is being operated in the current environment. The air conditioning requirements are inadequate for personnel operating the AFIRMS equipment. Block 2 air conditioning requirements analysis will address this shortcoming as well as any additional air conditioning requirements.

3.7.4 Site Surveys. Block 1 AFIRMS basic hardware is installed and the facilities are considered adequate. Block 2 will require a new site survey to determine if facility modifications are required.

3.8 Prepare Test/Verification/Validation Plan. A Test/Verification/Validation Plan will be written to include the following:

After the site surveys have been completed and the system has been installed, each site's system is sufficiently tested, both stand alone and with other sites. The system software and its interfaces with other software modules such as the communications software and the database are tested and verified to ensure that they perform correctly. The communication lines between the various sites also are tested to verify that data update notifications are received when sent from other sites. Also, data transfer from Wing level to MAJCOM level and MAJCOM level to Air Staff level is verified over the

actual communication lines. A test for system load is performed to verify the capacity under which the system can successfully run. In addition, time tests are taken to verify compliance with data transaction speed requirements for each site. Tests involving power fluctuations and alternate power sources are performed to verify the prevention of system loss due to failure or inadequacy of backup power sources.

3.9 Prepare System/Subsystem Specifications. Once the analysis/requirements definition and system design have been completed, and the functional requirements for AFIRMS have been identified, they are set forth in system, subsystem, and database specifications. These technical documents detail the requirements to be satisfied by the block implementation effort.

The system specification (B-level) ties together the various subsystems, and defines system/subsystem/external interrelationships and interfaces. The B-level specifications are for system-wide requirements such as communications protocols and intersite interface gateways. Subsystem and database specifications are written (or updated) for each system implementation site. These are B-level specifications. These specifications are prepared for development personnel, and thus detail the environment and design elements. Program specifications (C-level) are provided as annexes to the subsystem specifications. All system/subsystem/database specifications are prepared in accordance with appropriate Air Force Automated Data Systems (ADS) Documentation Standards.

The system/subsystem/database specifications provide a summary of the system/subsystem/data characteristics and requirements. They contain a description of the system/subsystem as well as qualitative and quantitative descriptions of how the system/subsystem functions satisfy user requirements. In addition, the specification documents furnish descriptions of the following:

- 1) The equipment (existing as well as new equipment to be procured) required for the operation of the system/subsystem.
- 2) The support software (and test software, if required) with which the computer programs to be developed must interact.
- 3) The interfaces with other applications computer programs.

- 4) System security considerations such as the levels of availability, integrity, and confidentiality of the system and its components.
- 5) A presentation of overall system/subsystem controls.
- 6) The operating procedures of the system.
- 7) The logical flow of the system/subsystem.
- 8) System inputs, output and database.
- 9) The functions of the computer programs in the system/subsystem.

SECTION 4. DEVELOPMENT PHASE

The development steps required to create the specified products to meet the functional requirement of a block are outlined in the Basic EIP (Section 6). Two additional areas that are required for HQ USAF Implementation.

4.1 Integrate External Interfaces. External interfaces must link the system code within software modules (separate spawned processes), external library files or library routines, and external (i.e., non-AFIRMS) systems.

4.2 Integrate and Unit Test Application Modules. In the top-down approach, the total AFIRMS system is not integrated as a whole; rather it is broken into functional application modules that are coded, integrated, and tested separately, and then included into the whole. After each application module has successfully performed under specific functional tests, it is then integrated into the rest of the system and tested.

SECTION 5. INSTALLATION PHASE

5.1 Installation Procedures and Schedule. Block I installation is largely accomplished. The LPP installations are converted to operational system usage as detailed in subsequent sections.

5.1.1 Facility Modification. Facility modifications were minimal for the LPP. The equipment is in place and no additional modifications are expected in Block I.

5.1.2 Communications Lines Installation. Communications lines equipment used in the LPP are being retained for the HQ USAF operational AFIRMS. Software support is provided by DECnet and KG84As are used for secure transmission. Modems are required at the sending and receiving sites. Transmission is either analog (ground) or digital (satellite), or a combination of both.

5.1.3 Hardware Installation. Block I hardware is basically installed and ready for use in the operational AFIRMS. Equipment currently installed consists of:

- one (1) VAX 11/750
- one (1) Chromatics CGC 7900 Color Graphics Computer
- one (1) VT-240 Color Terminal
- two (2) DST-102 Black and White Terminals (TEMPEST)
- one (1) ACT-1 Color Printer
- one (1) MATRIX 3000 Color Graphic Camera
- one (1) LA100 Console

Additional hardware installation required for Block I consists of:

- a. Color graphics terminals, two (2) each: Logistics and Planning
- b. Other equipment identified during the analysis phase of Block I.

SECTION 6. DETAILED HQ USAF SEGMENT IMPLEMENTATION SCHEDULE, BLOCK 1

The HQ USAF detailed segment schedule for Block 1 will be completed during the analysis/requirements Definition Phase, Block 1.

APPENDIX G. MILITARY AIRLIFT COMMAND (MAC) SEGMENT PLAN

SECTION I. GENERAL PURPOSE

This appendix to the EIP provides the direction for implementing AFIRMS at HQ MAC. This appendix, along with the basic EIP, provides the specific organization, detailed schedules, and responsibilities for work required to implement AFIRMS. The reader should refer to the basic EIP for background information, overall schedules, and general system analysis/development guidance. The HQ MAC appendix to the EIP is intended to be a "living" document, and is updated periodically to reflect the recent HQ MAC implementation planning.

SECTION 2. EVOLUTIONARY IMPLEMENTATION PLAN OVERVIEW

2.1 Implementation Elements. The MAC AFIRMS Segment Plan is composed of a number of blocks, each with a set of phases. Each block is a specified set or subset of AFIRMS functional products which, when implemented, provide a specific ability level within the AFIRMS functional capabilities. AFIRMS products are computer programs which accomplish specific processes at a specified level of detail within a basic AFIRMS function.

A block of AFIRMS products is implemented by the accomplishment of specific actions within five phases. These phases are:

- a. Analysis/Requirements Definition
(Results in completion of subsystem specifications)
- b. Development
(Results in completion of integrated/tested program coding)
- c. Installation
(Results in site installations of hardware and software)
- d. Operations
(Results in use of the installed block capabilities)
- e. Systems Integration/Management
(Results in coordinated accomplishment of all phases of the block and in adherence to the AFIRMS Management Plan)

2.2 Schedule. The overall MAC implementation plan is shown in Figure 2-1.

SECTION 3. ANALYSIS/REQUIREMENTS DEFINITION PHASE

3.1 Survey Users. The Analysis/Requirements Definition Phase consists of those steps necessary to design and specify, in detail, the functional needs programmed for a block in the EIP. These steps are the identification or confirmation of metrics, the design of the functional architectures with associated cost benefit analysis, system design, installation planning, and preparation of specifications. Survey efforts identify functional users of AFIRMS, identify general functional requirements, accomplish the preliminary facilities survey, and facilitate communication between the systems developer and the end user(s) of the system. Visits to work locations are accomplished to gain first-hand knowledge of the users' requirements and their contextual environment. Upon arrival at the survey site, the analysts conduct an in-briefing to inform the AFIRMS project officer and other key personnel of the reason for the visit and the goals of the user survey. The analysts use whatever tools are necessary to survey the users. Examples are:

- a. The use of questionnaires. Questionnaires provide a means of collecting consistent sets of information from a large/number of people in a short period of time.
- b. Interviewing. Interview questions lead to discussions about the current and desired future systems, both formal and informal. The analysts interview a cross section of the personnel to get a good feel for the users' operation and the spectrum of user requirements.
- c. Review of Management Indicators. Organizations use a variety of indicators to assign tasking and measure productivity, capability, and performance. The analysts inventory those indicators carefully to determine their use, the source of data, methods of compilation, and relevance as possible AFIRMS metrics.
- d. Preliminary Analysis of the Facilities. The analysts note the working environment. Many operations are scattered among several locations. The analysts determine the method of communication and the interface requirements between operations occurring at separate locations. Preliminary identification of available facilities, power sources, air conditioning, and access routes is accomplished.

When the survey is finished, the analyst team leader conducts an exit briefing with the AFIRMS project office and key personnel within the organization.

3.2 Identify/Confirm Metric(s). During the survey of the users, the unit's standards or indicators that measure tasking and performance are identified. The rationale for the metric, the source(s) of information, and the use of particular indicators or standards by a

higher headquarters are determined. Some metrics may be for local use only. Other metrics are passed to higher headquarters for consolidation, analysis, and decision support. Other indicators or standards may be used as productivity measures. These indicators or standards are of primary importance to AFIRMS. They integrate resource requirements to achieve the desired mission results. As an example, the metric for tactical air forces is the sortie. The sortie integrates the essential resource components of a mission (aircraft, aircrew, fuels, and missions). It also provides a focus for the application of generative resources (such as spares) which are elemental to providing the basic aircraft resource.

3.3 Design Functional Architecture. The design of the MAC Block I functional architecture will provide for the tailoring of core/basic AFIRMS functional capabilities to MAC-unique needs where applicable, and the development of new functional products as required.

A functional analysis of all potential MAC AFIRMS users determines how different types of resource data affect the capability of a Wing's mission, and how the different users (Wings, MAJCOMs, and the Air Staff) use the same data for their particular purposes. A structured, "top-down" approach is taken for the functional architectural design once the "bottom-up" requirements analysis has been accomplished. All functional areas are broken down to *sub-functions* in enough detail to describe the relevant activities. In examining a function, the analyst gives specific attention to the interfaces, both into and out of the functional areas. Analysis also determines the organization element which controls the various activities. Availability and sufficiency of both existing communications and existing automated data systems establish constraints and requirements for the functional architecture. The functional architecture design provides the framework for the development of system design, specifications, and database structure. Specific steps necessary for functional architectural design are described in subsequent subsections.

3.3.1 Select AFIRMS Products. AFIRMS Products, which have been developed, relate to:

- a. Unit and base level status information
- b. Wing level resource status summary
- c. Capability assessment model (sortie generation)
- d. Integrated resource capability assessment

- e. Individual resource capability assessment
- f. Dollar costing of resource allocations against requirements
- g. "Optimization" of dollar allocation among resources to maximize capability.

After the requirement analysis, the available AFIRMS products are reviewed to see if they can meet, or be modified to meet, the various functional requirements.

The functional architecture includes existing or modified AFIRMS products, if applicable. Use of those products reduces the system development time considerably and avoids duplication of development efforts.

3.3.2 Design Additional Products. The user survey(s) may identify new functional requirements for which AFIRMS products are not yet developed. As the user identifies requirements that have not been previously defined, the analyst will design application modules for the new products based upon thorough, detailed functional requirements analysis. It should be emphasized that these are NEW products which MAY be deferred for implementation in subsequent functional block product development phases.

The functional analysis that establishes the *functional architecture* will also identify MAC unique requirements. These MAC unique requirements are likely to be the primary source of new AFIRMS products. These new products are identified, designed, and specified to a level of detail that will allow program coding to proceed.

3.3.3 Define/Design Interfaces. MAC AFIRMS Block 2 will interface with WWMCCS and DDN/AUTODIN for communications with HQ USAF and other major commands, and those Air Force functional systems identified during the Block 1 Analysis Phase.

Very few, if any, functional areas operate in isolation. During the survey of users, interfaces will become apparent. There are inter- and intra-functional interfaces. Intra-functional interfaces are internal to AFIRMS or AFIRMS users/sites. An inter-functional interface is one outside of AFIRMS. The interfunctional interface will link AFIRMS with other Air Force functional areas and/or automated systems. While the user survey will uncover the obvious interfaces, less obvious interfaces may be identified in the design of the functional architecture, and detailed systems specifications. These interfaces

are documented, specified, and included in the design of AFIRMS. The specifications identify the method of interface (air gap, tape-to-tape, hardwire) along with the impact which the interface has on the users of both AFIRMS and the external system(s).

3.3.4 Define Functional Baseline. The functional baseline for MAC Block 2 is the set of core AFIRMS functional capabilities adapted for support of MAC functional requirements. Requirements of the operational system are to be detailed in the MAC Subsystem Specifications.

This is the contract between the user and developer. The functional baseline includes all the requirements identified in the user survey and requirements analysis efforts, to include the metrics and any new applications. To ensure the accuracy of the information, the baseline is certified by the HQ USAF and MAJCOM configuration control authorities before any development work starts. With baseline certification, the OPR/PMO team assumes responsibility for new block development. Any enhancement to the block functionality, change in requirements, or additional development efforts must be approved by the configuration control authorities.

3.3.5 Design/Size Database. Design of the AFIRMS segment database consists of three stages: conceptual design, logical design, and physical design. A complete understanding of the relationships that exist for all data in a segment is needed for the conceptual design. Next, the conceptual database design is mapped into a series of logical database designs from each different user's perspective. The physical design and implementation of this logical design follow, with the peculiarities of the chosen DBMS establishing essential guidelines as to the actual structure of the data.

The logical database design does not normally change within a MAJCOM segment unless new information has been gathered. From the outset, it should reflect similarities that exist in all MAJCOMs for maximum consistency from segment to segment. Minor changes to the database design, and to the software that accesses it, are to be expected.

Likewise, the logical designs should reflect as much similarity between segments as is possible. Here, even more variation is expected because of some of the fundamental differences that exist among MAJCOMs. For sites within a segment, excluding the MAJCOM HQ, there should be little, if any, change to the logical designs. That is to say, all wings typically have the same functional areas and, consequently, AFIRMS data requirements within those functional areas are the same. This assumption is probably accurate for the most part, but minor exceptions should be expected.

Within a MAJCOM segment, the physical implementation of each site's database is likely to vary depending on the priority of individual needs. Thus, the database is optimized with available DBMS tuning mechanisms to better support products favored at that site. A goal of these optimizations is that very little or no change need be made to existing AFIRMS software at that site.

The conceptual and logical database design stages of the AFIRMS database at any given site in a particular segment will occur in the Analysis/Requirements Definition Phase of the initial implementation. Known data requirements of all functional areas of each site are accommodated during this phase. Logical database changes can cause major database design modifications across the board. Likewise, switching from one DBMS to another cannot be readily accommodated. Modifications to the physical design of the AFIRMS databases within a segment, on the other hand, continue for tuning purposes and should pose no major problem.

Sizing estimates are gathered during each design stage, approaching more realistic numbers as the design progresses. A reasonable sizing estimate is achievable after the logical design stage, since all data requirements are defined. Once again, it is reasonable to suggest that the sizing estimates should not vary greatly from one site to another within a segment, unless one site possesses many more resources than others. After a particular DBMS is chosen for use within a segment, the most accurate database sizing estimate can be made since actual data storage needs can be assessed and the amount of software which accesses that DBMS can be better estimated.

3.4 Define Alternative Architectures. Suitable options for the design of the MAC Block 2 system architecture are dependent to a great extent upon hardware/automated systems already in place (or planned for) at MAC facilities. These options form the basis for the definition of alternative system architectures.

3.5 Cost/Benefit Evaluation. The objective of the cost/benefit evaluation is to provide the block functional capabilities as economically as possible and to ensure that the block implementation is constrained by the budget as defined and refined within the Economic Analysis document and the Management Plan, Volume I - Program Administration. A Cost/Benefit Evaluation is performed for each segment and, if required, each block within each segment. The purpose of the evaluation is to document the major analysis steps for selecting the most cost-effective means of accomplishing the AFIRMS objectives. The first Cost/Benefit Evaluation of Block I implementation for each segment may be included in a Segment Cost/Benefit Evaluation document or it can be written as a separate document. Regardless, the Block I Cost/Benefit Evaluation must agree with, and provide more detail to, the recommended alternative and costs selected in the Segment Cost/Benefit Evaluation. The Cost/Benefit Evaluations for succeeding blocks in each segment must accommodate prior Segment and Block Evaluations.

The length and level of detail in the Cost/Benefit Evaluation will depend on the total cost of the implementation alternatives and the level of approval required in AFR 700-series regulations. AFR 178-1, AFR 173-13, and AFP 178-8 guide the evaluation study methods and cost figures.

3.6 Design System. The system design is the definition of the relationship among the hardware and software components that accomplish the functions defined in the functional architecture. The functions of the DBMS, applications and communications software, and hardware (if appropriate) are decomposed into subordinate components modules. The hardware and software modules are defined in sufficient detail to produce the system/subsystem specifications. The decomposition of functions is accomplished using structured "top-down" techniques, which concentrate on data flow, control, and timing.

3.7 Define Installation Requirements.

3.7.1 Structures Affected. Buildings scheduled to house new or upgraded equipment, and specific room locations within the buildings, are identified in this section. Once the rooms are determined, the positioning of each piece of equipment within the room is detailed so that the site survey can identify specific installation requirements such as the

access plan, location of power plugs, physical altering of walls, ceilings and floors, etc. This section is updated once the results of the site survey are available, and final determinations of site installation configurations are accomplished. Specific responsibility for structural modifications is assigned in this section.

3.7.2 Power/Communications/TEMPEST Requirements. The specific hardware placed in each room determines electrical power requirements and equipment layout plans due to possible TEMPEST spacing requirements. The power and TEMPEST requirements for a piece of hardware selected during the development phase may be determined by referencing the manufacturer's site preparation manual or similar document. These documents provide the voltage, amperage, and frequency requirements as well as any TEMPEST constraints which must be observed. Inter and intra site communications requirements are derived from the system design. Intra site communications depend upon the number of functional users at the site and the relationships between the AFIRMS products used by these functional areas. Inter site communications requirements for connectivity are to the higher level AFIRMS site, to the remotely located elements of the site organization, and to either the higher or the remote elements as backup connectivity. After individual requirements are identified, they are aggregated by room in order to detail requirements by building. *These requirements are updated to reflect any approved changes to the installation configuration identified during the site survey.* The final content of this section, in each Segment Plan, identifies, or provides reference to, the detailed electrical requirements for the installation, and assigns specific responsibility for achieving electrical/communications/TEMPEST actions necessary to the installation.

3.7.3 Air Conditioning Requirements. Typical air conditioning requirements may be obtained from manufacturers' site preparation manuals which are representative of the expected equipment. These requirements are specified for the main processor and other environmentally sensitive equipment, such as intelligent color graphics terminals. Combined-site air conditioning requirements are derived for use during the site survey. These requirements, as modified by the findings of the site survey, specify the air conditioning installation. Specific responsibility for air conditioning services is assigned in this section.

3.7.4 Site Surveys. Once the facility, power, air conditioning, and TEMPEST requirements have been determined, site surveys are accomplished. This must be scheduled with the appropriate Engineering Installation Group (EIG) or Information Systems Group well in advance of the planned installation date. The site surveys determine exactly what facility modifications are required to accommodate the hardware configurations. Details such as equipment locations, power sources, electrical lines, communications lines, and air conditioners are confirmed. Site surveys must be scheduled well in advance in order to accommodate installation, communications, and TEMPEST lead times. Responsibility for site survey(s) is assigned in this section.

3.8 Prepare Test/Verification/Validation Plan. A Test/Verification/Validation Plan for the segment applicable to each functional block implementation provides the procedures by which AFIRMS implementations are certified. To certify the block implementation, a number of actions are required. After the site surveys have been completed and the system has been installed, each site's system is completely tested, both stand-alone and with other sites. The system software and its interfaces with other software modules, such as the communications software and the database, are tested and verified to ensure that they perform correctly. The communications lines between the various sites also are tested to verify that data update notifications are received when sent from other sites. Also, data transfer from Wing level to MAJCOM level and MAJCOM level to Air Staff level is verified over the actual communications lines. A test for system load is performed to verify the capacity under which the system can successfully run. In addition, time tests are taken to verify compliance with data transaction speed requirements for each site. Tests involving power fluctuations and alternate power sources are performed to verify the prevention of system loss due to failure or inadequacy of backup power sources. Security tests and evaluations are integral parts of the Test/Verification/Validation Plan.

3.9 Prepare System/Subsystem Specifications. Once the analysis/requirements definition and system design have been completed, and the functional requirements for AFIRMS have been identified, they are set forth in system, subsystem, and database specifications. These technical documents detail the requirements to be satisfied by the block implementation effort.

The system specification (B-level) ties together the various subsystems, and defines system/subsystem/external interrelationships and interfaces. The B-level specifications are for systems-wide requirements such as communications protocols and intersite interface gateways. Subsystem and database specifications are written (or updated) for each system implementation site. These are B-level specifications. These specifications are prepared for development personnel, and thus detail the environment and design elements. Program specifications (C-level) are provided as annexes to the subsystem specifications. All system/subsystem/database specifications are prepared in accordance with appropriate Air Force Automated Data Systems (ADS) Documentation Standards.

The system/subsystem/database specifications provide a summary of the system/subsystem/data characteristics and requirements. They contain a description of the system/subsystem as well as qualitative and quantitative descriptions of how the system/subsystem functions satisfy user requirements. In addition, the specification documents furnish descriptions of the following:

- 1) The equipment (existing as well as new equipment to be procured) required for the operation of the system/subsystem.
- 2) The support software (and test software, if required) with which the computer programs to be developed must interact.
- 3) The interfaces with other applications computer programs.
- 4) System security considerations such as the levels of availability, integrity, and confidentiality of the system and its components.
- 5) A presentation of overall system/subsystem controls.
- 6) The operating procedures of the system.
- 7) The logical flow of the system/subsystem.
- 8) System inputs, output and database.
- 9) The functions of the computer programs in the system/subsystem.

SECTION 4. DEVELOPMENT PHASE

The development steps required to create the specified products to meet the functional requirements of a Block are outlined in the Basic EIP (Section 6).

SECTION 5. INSTALLATION PHASE

5.1 Installation Procedures and Schedule. Upon completion of the site survey, the schedules for the procurement of needed supplies, electrical work, communications links, and facility modifications are developed. These schedules are synchronized with the procurement of equipment, delivery of equipment, and the rest of the installation actions, such as software installation and training in a master implementation plan. Responsibility for establishing and accomplishing the installation schedules is assigned when the schedules are established. Since the schedules were established during the Development Phase, they are first verified and updated early in the Installation Phase. Also, some of the more drastic facility modifications can be initiated during the final efforts of the Development Phase.

5.1.1 Facility Modification. Before hardware or communications equipment can be fully installed, the facilities must be modified as specified in the site survey.

5.1.2 Communications Lines Installation. The schedule for running communications lines can overlap the end of facility modification schedules, but a functional area cannot receive its lines until all physical modifications have been performed at that functional area's location and at the central node location. Ideally, the communications lines installations are completed at the same time as any room modifications are done.

5.1.3 Hardware Installation. Hardware cannot be installed and unit-tested at a location until the physical modifications, if any, are completed at that location. Once the communications equipment has been installed, a more complete test of the hardware can be performed.

APPENDIX I. STRATEGIC AIR COMMAND (SAC) SEGMENT PLAN

SECTION I. PURPOSE

This appendix to the EIP provides the direction for implementing AFIRMS at HQ SAC. This appendix, along with the basic EIP, provides the specific organization, detailed schedule, and responsibilities for work required to implement AFIRMS. The reader should refer to the basic EIP for background information, overall schedules, and general system analysis/development guidance. The HQ SAC appendix to the EIP is intended to be a given "living" document, and is updated periodically to reflect the current HQ SAC implementation planning.

SECTION 2. EVOLUTIONARY IMPLEMENTATION PLAN OVERVIEW

2.1 Implementation Elements. The SAC AFIRMS Segment Plan is composed of a number of blocks, each with a set of phases. Each block is a specified set or subset of AFIRMS functional products which, when implemented, provide a specific ability level within the AFIRMS functional capabilities. AFIRMS products are computer programs which accomplish specific processes at a specified level of detail within a basic AFIRMS function. A block of AFIRMS products is implemented by the accomplishment of specific actions within five phases. These phases are:

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(Results in completion of integrated/tested program coding)
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(Results in site installations of hardware and software)
- d. Operations
(Results in use of the installed block capabilities)
- e. Systems Integration/Management
(Results in coordinated accomplishment of all phases of the block and in adherence to the AFIRMS Management Plan).

2.2 Schedule. The overall SAC implementation plan is shown in Figure 2-1.

SECTION 3. ANALYSIS/REQUIREMENTS DEFINITION PHASE

3.1 Survey Users. The Analysis/Requirements Definition Phase consists of those steps necessary to design and specify, in detail, the functional needs programmed for a block in the EIP. These steps are the identification or confirmation of metrics, the design of the functional architectures with associated cost benefit analysis, system design, installation planning, and preparation of specifications. Survey efforts identify functional users of AFIRMS, identify general functional requirements, accomplish the preliminary facilities survey, and facilitate communication between the systems developer and the end user(s) of the system. Visits to work locations are accomplished to gain first-hand knowledge of the users' requirements and their contextual environment. Upon arrival at the survey site, the analysts conduct an in-briefing to inform the AFIRMS project officer and other key personnel of the reason for the visit and the goals of the user survey. The analysts use whatever tools are necessary to survey the users. Examples are:

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higher headquarters are determined. Some metrics may be for local use only. Other metrics are passed to higher headquarters for consolidation, analysis, and decision support. Other indicators or standards may be used as productivity measures. These indicators or standards are of primary importance to AFIRMS. They integrate resource requirements to achieve the desired mission results. As an example, the metric for tactical air forces is the sortie. The sortie integrates the essential resource components of a mission (aircraft, aircrew, fuels, and missions). It also provides a focus for the application of generative resources (such as spares) which are elemental to providing the basic aircraft resource.

3.3 Design Functional Architecture. The design of the SAC Block I functional architecture will provide for the tailoring of core/basic AFIRMS functional capabilities to SAC-unique needs where applicable, and the development of new functional products as required.

A functional analysis of all potential SAC AFIRMS users determines how different types of resource data affect the capability of a Wing's mission, and how the different users (Wings, MAJCOMs, and the Air Staff) use the same data for their particular purposes. A structured, "top-down" approach is taken for the functional architectural design once the "bottom-up" requirements analysis has been accomplished. All functional areas are broken down to sub-functions in enough detail to describe the relevant activities. In examining a function, the analyst gives specific attention to the interfaces, both into and out of the functional areas. Analysis also determines the organization element which controls the various activities. Availability and sufficiency of both existing communications and existing automated data systems establish constraints and requirements for the functional architecture. The functional architecture design provides the framework for the development of system design, specifications, and database structure. Specific steps necessary for functional architectural design are described in subsequent subsections.

3.3.1 Select AFIRMS Products. AFIRMS Products, which have been developed, relate to:

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specifications identify the method of interface (air gap, tape-to-tape, hardwire) along with the impact which the interface has on the users of both AFIRMS and the external system(s).

3.3.4 Define Functional Baseline. The functional baseline for SAC Block 2 is the set of core AFIRMS functional capabilities adapted for support of SAC functional requirements.

This is the contract between the user and developer. The functional baseline includes all the requirements identified in the user survey and requirements analysis efforts, to include the metrics and any new applications. To ensure the accuracy of the information, the baseline is certified by the HQ USAF and MAJCOM configuration control authorities before any development work starts. With baseline certification, the OPR/PMO team assumes responsibility for new block development. Any enhancement to the block functionality, change in requirements, or additional development efforts must be approved by the configuration control authorities.

3.3.5 Design/Size Database. Design of the AFIRMS segment database consists of three stages: conceptual design, logical design, and physical design. A complete understanding of the relationships that exist for all data in a segment is needed for the conceptual design. Next, the conceptual database design is mapped into a series of logical database designs from each different user's perspective. The physical design and implementation of this logical design follow, with the peculiarities of the chosen DBMS establishing essential guidelines as to the actual structure of the data.

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Likewise, the logical designs should reflect as much similarity between segments as is possible. Here, even more variation is expected because of some of the fundamental differences that exist among MAJCOMs. For sites within a segment, excluding the

MAJCOM HQ, there should be little, if any, change to the logical designs. That is to say, all wings typically have the same functional areas and, consequently, AFIRMS data requirements within those functional areas are the same. This assumption is probably accurate for the most part, but minor exceptions should be expected.

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The conceptual and logical database design stages of the AFIRMS database at any given site in a particular segment will occur in the Analysis/Requirements Definition Phase of the initial implementation. Known data requirements of all functional areas of each site are accommodated during this phase. Logical database changes can cause major database design modifications across the board. Likewise, switching from one DBMS to another cannot be readily accommodated. Modifications to the physical design of the AFIRMS databases within a segment, on the other hand, continue for tuning purposes and should pose no major problem.

Sizing estimates are gathered during each design stage, approaching more realistic numbers as the design progresses. A reasonable sizing estimate is achievable after the logical design stage, since all data requirements are defined. Once again, it is reasonable to suggest that the sizing estimates should not vary greatly from one site to another within a segment, unless one site possesses many more resources than others. After a particular DBMS is chosen for use within a segment, the most accurate database sizing estimate can be made since actual data storage needs can be assessed and the amount of software which accesses that DBMS can be better estimated.

3.4 Define Alternative Architecture. Suitable options for the design of the SAC Block 2 system architecture are dependent to a great extent upon hardware/automated systems already in place (or planned for) at SAC facilities. These options form the basis for the definition of alternative system architectures.

3.5 Cost/Benefit Evaluation. The objective of the cost/benefit evaluation is to provide the block functional capabilities as economically as possible and to ensure that the block implementation is constrained by the budget as defined and refined within the Economic Analysis document and the Management Plan, Volume 1 - Program Administration. A Cost/Benefit Evaluation is performed for each segment and, if required, each block within each segment. The purpose of the evaluation is to document the major analysis steps for selecting the most cost-effective means of accomplishing the AFIRMS objectives. The first Cost/Benefit Evaluation of Block 1 implementation for each segment may be included in a Segment Cost/Benefit Evaluation document or it can be written as a separate document. Regardless, the Block 1 Cost/Benefit Evaluation must agree with, and provide more detail to, the recommended alternative and costs selected in the Segment Cost/Benefit Evaluation. The Cost/Benefit Evaluations for succeeding blocks in each segment must accommodate prior Segment and Block Evaluations.

The length and level of detail in the Cost/Benefit Evaluation will depend on the total cost of the implementation alternatives and the level of approval required in AFR 700-series regulations. AFR 178-1, AFR 173-13, and AFP 178-8 guide the evaluation study methods and cost figures.

3.6 Design System. The system design is the definition of the relationship among the hardware and software components that accomplish the functions defined in the functional architecture. The functions of the DBMS, applications and communications software, and hardware (if appropriate) are decomposed into subordinate components modules. The hardware and software modules are defined in sufficient detail to produce the system/subsystem specifications. The decomposition of functions is accomplished using structured "top-down" techniques, which concentrate on data flow, control, and timing.

3.7 Define Installation Requirements.

3.7.1 Structures Affected. Buildings scheduled to house new or upgraded equipment, and specific room locations within the buildings, are identified in this section. Once the rooms are determined, the positioning of each piece of equipment within the room is detailed so that specific installation requirements can be determined: i.e., access plan,

location of power plugs, physical altering of walls, ceilings, and floors, etc. These requirements are updated once the results of the site survey are available, and final determinations of site installation configurations are accomplished. Specific responsibility for structural modifications is assigned in this section.

3.7.2 Power/Communications/TEMPEST Requirements. The specific hardware placed in each room determines electrical power requirements and equipment layout plans due to possible TEMPEST spacing requirements. The power and TEMPEST requirements for a piece of hardware selected during the development phase may be determined by referencing the manufacturer's site preparation manual or similar document. These documents provide the voltage, amperage, and frequency requirements as well as any TEMPEST constraints which must be observed. Inter and intra site communications requirements are derived from the system design. Intra site communications depend upon the number of functional users at the site and the relationships between the AFIRMS products used by these functional areas. Inter site communications requirements for connectivity are to the higher level AFIRMS site, to the remotely located elements of the site organization, and to either the higher or the remote elements as backup connectivity. After individual requirements are identified, they are aggregated by room in order to detail requirements by building. *These requirements are updated to reflect any approved changes to the installation configuration identified during the site survey.* The final content of this section, in each Segment Plan, identifies, or provides reference to, the detailed electrical requirements for the installation, and assigns specific responsibility for achieving electrical/communications/TEMPEST actions necessary to the installation.

3.7.3 Air Conditioning Requirements. Typical air conditioning requirements may be obtained from manufacturers' site preparation manuals which are representative of the expected equipment. These requirements are specified for the main processor and other environmentally sensitive equipment, such as intelligent color graphics terminals. Combined-site air conditioning requirements are derived for use during the site survey. These requirements, as modified by the findings of the site survey, specify the air conditioning installation. Specific responsibility for air conditioning services is assigned in this section.

3.7.4 Site Surveys. Once the facility, power, air conditioning, and TEMPEST requirements have been determined, site surveys are accomplished. This must be scheduled with the appropriate Engineering Installation Group (EIG) or Information Systems Group well in advance of the planned installation date. The site surveys determine exactly what facility modifications are required to accommodate the hardware configurations. Details such as equipment locations, power sources, electrical lines, communications lines, and air conditioners are confirmed. Site surveys must be scheduled well in advance in order to accommodate installation, communications, and TEMPEST lead times. Responsibility for site survey(s) is assigned in this section.

3.8 Prepare Test/Verification/Validation Plan. A Test/Verification/Validation Plan for the segment applicable to each functional block implementation provides the procedures by which AFIRMS implementations are certified. To certify the block implementation, a number of actions are required. After the site surveys have been completed and the system has been installed, each site's system is completely tested, both stand-alone and with other sites. The system software and its interfaces with other software modules, such as the communications software and the database, are tested and verified to ensure that they perform correctly. The communications lines between the various sites also are tested to verify that data update notifications are received when sent from other sites. Also, data transfer from Wing level to MAJCOM level and MAJCOM level to Air Staff level is verified over the actual communications lines. A test for system load is performed to verify the capacity under which the system can successfully run. In addition, time tests are taken to verify compliance with data transaction speed requirements for each site. Tests involving power fluctuations and alternate power sources are performed to verify the prevention of system loss due to failure or inadequacy of backup power sources. Security tests and evaluations are integral parts of the Test/Verification/Validation Plan.

3.9 Prepare System/Subsystem Specifications. Once the analysis/requirements definition and system design have been completed, and the functional requirements for AFIRMS have been identified, they are set forth in system, subsystem, and database specifications. These technical documents detail the requirements to be satisfied by the block implementation effort.

The system specification (B-level) ties together the various subsystems, and defines system/subsystem/external interrelationships and intertaces. The B-level specifications are for systems-wide requirements such as communications protocols and intersite interface gateways. Subsystem and database specifications are written (or updated) for each system implementation site. These are B-level specifications. These specifications are prepared for development personnel, and thus detail the environment and design elements. Program specifications (C-level) are provided as annexes to the subsystem specifications. All system/subsystem/database specifications are prepared in accordance with appropriate Air Force Automated Data Systems (AFS) Documentation Standards.

The system/subsystem/database specifications provide a summary of the system/subsystem/data characteristics and requirements. They contain a description of the system/subsystem as well as qualitative and quantitative descriptions of how the system/subsystem functions satisfy user requirements. In addition, the specification documents furnish descriptions of the following:

- 1) The equipment (existing as well as new equipment to be procured) required for the operation of the system/subsystem.
- 2) The support software (and test software, if required) with which the computer programs to be developed must interact.
- 3) The interfaces with other applications computer programs.
- 4) System security considerations such as the levels of availability, integrity, and confidentiality of the system and its components.
- 5) A presentation of overall system/subsystem controls.
- 6) The operating procedures of the system.
- 7) The logical flow of the system/subsystem.
- 8) System inputs, output and database.
- 9) The functions of the computer programs in the system/subsystem.

SECTION 4. DEVELOPMENT PHASE

The development steps required to create the specified products to meet the functional requirements of a Block are outlined in the Basic EIP (Section 6).

SECTION 5. INSTALLATION PHASE

5.1 Installation Procedures and Schedule. Upon completion of the site survey, the schedules for the procurement of needed supplies, electrical work, communications links, and facility modifications are developed. These schedules are synchronized with the procurement of equipment, delivery of equipment, and the rest of the installation actions, such as software installation and training in a master implementation plan. Responsibility for establishing and accomplishing the installation schedules is assigned when the schedules are established. Since the schedules were established during the Development Phase, they are first verified and updated early in the Installation Phase. Also, some of the more drastic facility modifications can be initiated during the final efforts of the Development Phase.

5.1.1 Facility Modification. Before hardware or communications equipment can be fully installed, the facilities must be modified as specified in the site survey.

5.1.2 Communications Lines Installation. The schedule for running communications lines can overlap the end of facility modification schedules, but a functional area cannot receive its lines until all physical modifications have been performed at that functional area's location and at the central node location. Ideally, the communications lines installations are completed at the same time as any room modifications are done.

5.1.3 Hardware Installation. Hardware cannot be installed and unit-tested at a location until the physical modifications, if any, are completed at that location. Once the communications equipment has been installed, a more complete test of the hardware can be performed.

END

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